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PART F. ANNUAL REPORT OF THE GEOLOGICAL SURVEY OF CANADA. VOL. IX., 1896.

GEOLOGICAL SURVEY OF CANADA

G. M. DAWSON, C.M.G., LL.D., F.R.S., DIRECTOR

REPORT

ON THE

DOOBAUNT, KAZAN AND FERGUSON RIVERS

AND THE

NORTH-WEST COAST OF HUDSON BAY

AND ON

Two overland routes from Hudson Bay to Lake Winnipeg

BY

J. BURR TYRRELL, M.A., F.G.S., &c.



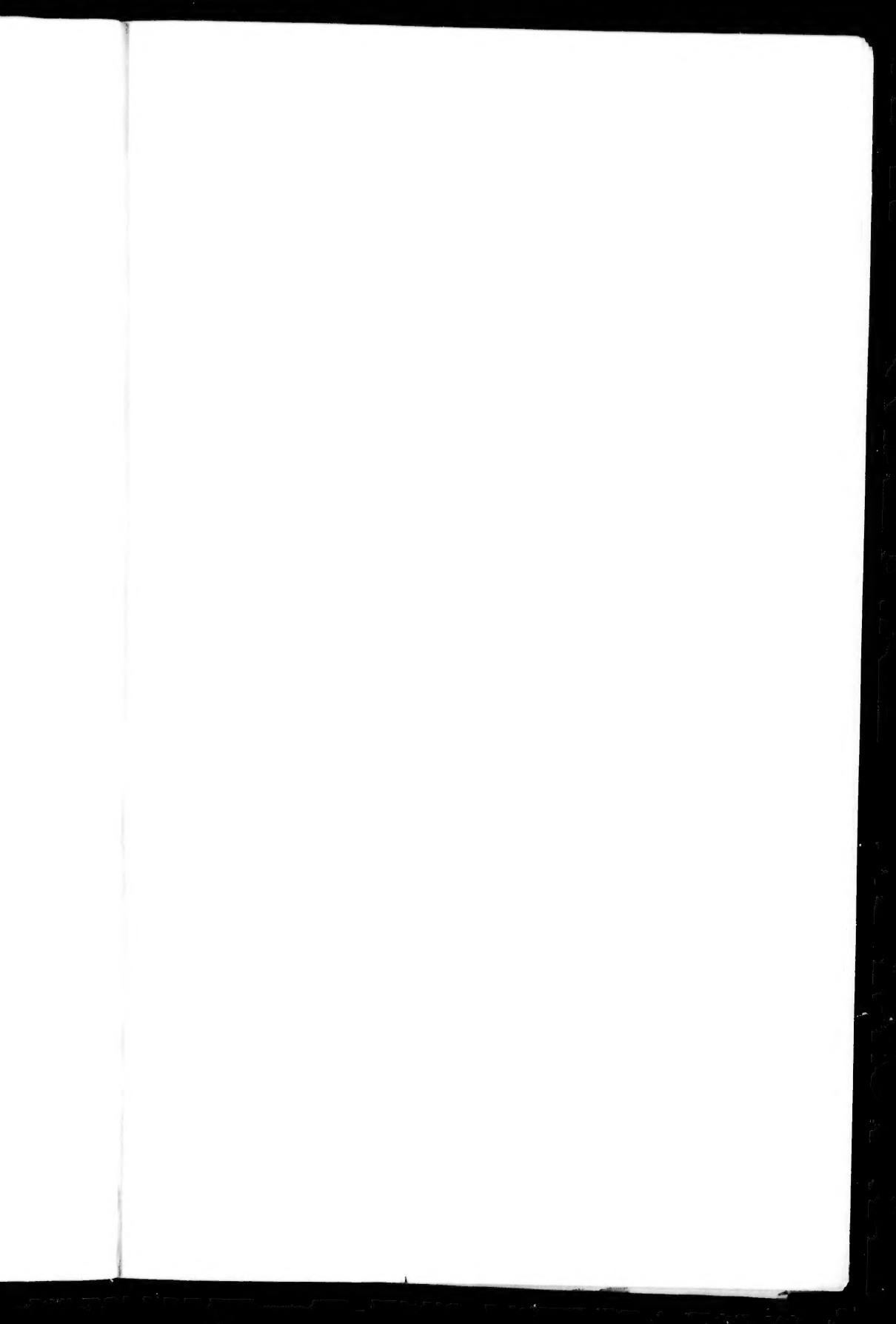
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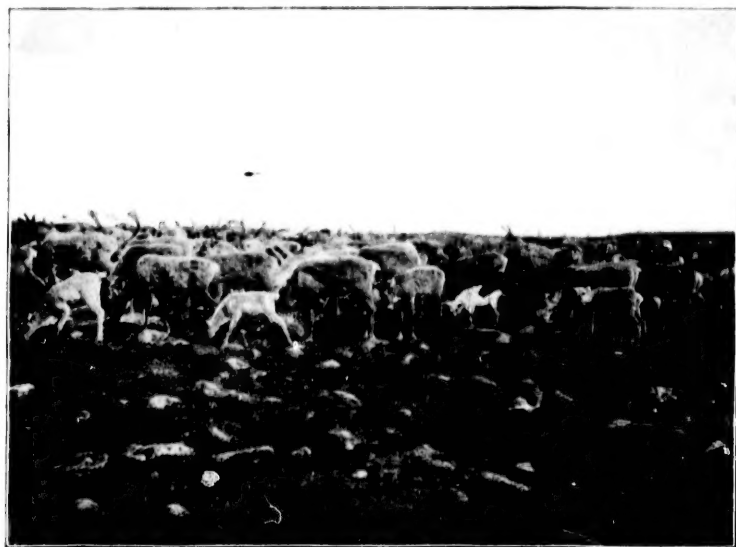
PRINTED BY S. E. DAWSON, PRINTER TO THE QUEEN'S MOST
EXCELLENT MAJESTY

1897

No. 618

Price 30 cents.





July 30, 1893.



J. B. TYRRELL.—Photo. July 30, 1893.

BARREN-GROUND CARIBOU ON THE SHORE OF CAREY LAKE.

Latitude 62° 10'. Longitude 102° 45'.

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GEORGE M. DAWSON, C.M.G., LL.D., F.R.S.,

Director, Geological Survey of Canada.

SIR,—I beg to present a report on the geology and general resources of the region explored in 1893 and 1894, embraced in an area of about 200,000 square miles, lying north of the 59th parallel of latitude, and west of Hudson Bay. The explorations included the examination and survey of Telzoa or Doobaunt, Kazan, Ferguson, Chipman and Cochran Rivers, Chesterfield Inlet, and the coast of Hudson Bay from Chesterfield Inlet to Churchill, and two overland routes, travelled in winter with dog-teams and sledges, between Churchill and Nelson Rivers.

That portion of the report giving an account of the explorations carried out in 1894 was prepared in the winter of 1895, but the part on the work of 1893 has been necessarily delayed because of the late arrival of the rock-specimens collected.

The surveys were originally plotted on a scale of two geographical miles to one inch, and are now shown on the accompanying map, reduced to a scale of twenty-five miles to one inch.

The illustrations, chosen from more than 400 photographs taken during the explorations, give a better idea of the characteristic features of the country than extended descriptions.

I have the honour to be, Sir,

Your obedient servant,

J. B. TYRRELL.

OTTAWA, 10th May, 1897.

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NOTE.—*The bearings throughout this Report refer to the true meridian.*

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INTRODUCTION.

The present report, and its accompanying map, is the result of two explorations made in the years 1893 and 1894, the former occupying eight and the latter seven months, counting in each case from the time of our departure until the time of our return to civilization. Dates of exploration.

The vast wilderness through which the lines of exploration passed, lies for the most part north of latitude 59°, and extends from the coast of Hudson Bay, westward to Lake Athabasca, comprising an area of not less than 200,000 square miles. Extent. The work of the party embraced a survey of the north shore of Lake Athabasca, the Chipman, Cochrane, Telzoa or Doobaunt, Thlewiaza, Kazan and Ferguson rivers, in whole or in part, Chesterfield Inlet, and the shore of Hudson Bay from Chesterfield Inlet to Churchill, as well as a line overland in winter, from Churchill to York Factory, and another from Churchill to Split Lake.

Since a large portion of this region lies north of the country where fur-bearing animals are abundant, it had not been travelled over by fur-traders, or even by voyageurs or Indians in search of furs, and the characters of the lakes and streams were, therefore, unknown to any but the few Indian and Eskimo deer-hunters who live on their banks, and who come south once or twice a year to trade wolf or fox skins for ammunition and tobacco. Country hitherto unknown.

Objects of
exploration.

It, therefore, seemed highly desirable to determine, not only the geographical features of the region, but also the question of the occurrence of minerals of value in it. The main object of these two expeditions was to obtain some clear idea of the character of the rocks that underlie this vast wilderness. While this object was constantly kept in view, surveys were made of the routes followed, and of any natural features observed on the lines of travel, observations were made on the range and character of the native population, the fauna, flora, climate and other features that seemed to be of interest.

Assistance.

During the season of 1893, I was assisted by James W. Tyrrell, C.E., D.L.S., who had spent one winter on the north shore of Hudson Strait, and had served for two seasons as assistant to Commander Gordon in the survey of Hudson Bay. He acted in the capacity of topographer and Eskimo interpreter to the expedition, and in addition made a large collection of plants, a list of which is given in Appendix III. In 1894, both the geological and topographical work devolved on the writer, but Mr. R. Munro-Ferguson, A.D.C. to His Excellency the Governor General, who accompanied him, did all in his power to further the general objects of the expedition.

Character
and extent of
surveys.

The sextant, solar compass and chronometer, with prismatic compasses and boat-logs, were the instruments chiefly employed. With them a survey was made of the north shore of Lake Athabasca, from Fort Chippewyan to Fond du Lac, where it was connected with the survey made in 1892; Chipman River to its source at the north end of Selwyn Lake; Telzoa or Doobaunt River, from its source in Daly Lake to its mouth in Chesterfield Inlet; Chesterfield Inlet; the shore of Hudson Bay from Chesterfield Inlet to Churchill; Cochrane River from its mouth in Reindeer Lake to its northern bend; two of the upper tributaries of Thlewiaza River; Kazan River from its source in Kasba on White Partridge Lake to a short distance below Yath-kyed Lake; Ferguson River from its source to its mouth; the winter trail from Churchill to York Factory; and a line travelled in winter from Churchill to Split Lake.

Length
of surveys.

The total length of these surveys amounts to rather more than 2900 miles. Of which 1073 miles, on lakes and quiet water, were measured with Massey's floating boat-log; 1312 were estimated by the rate of travel in the canoes; 515 were travelled on foot, the distances being in part estimated, and in part determined by pacing. Of this distance 475 miles were travelled in winter, while 40 miles were travelled in summer across portages over which it was necessary to make three or four trips in order to carry the canoes and cargo.

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In order to accomplish the above surveys it was necessary to travel 6100 miles beyond the lines of railway. Of this distance 3850 miles were travelled in canoes, 1200 miles on snowshoes, while the remainder was performed in conveyances drawn by dogs, horses, &c.

The above surveys were plotted by or under the direction of the Map writer on a scale of two geographical miles to one inch. These plans have been reduced to a scale of twenty-five statute miles to one inch, and are so shown on the accompanying map, and on the map accompanying the writer's "Report on the Country between Athabasca Lake and Churchill River."*

Wherever the rocks seemed to be of peculiar interest, or their characters could not readily be determined in the field, specimens three by four inches or larger were collected. Of some of these thin sections have been prepared for examination under the microscope. Those collected in 1893 have been submitted to a preliminary examination by the writer, with the occasional assistance of Mr. A. E. Barlow, of this Survey. Those collected in 1894 have not yet been examined.

SUMMARY OF PROCEEDINGS.

On receiving instructions, in 1893, to make an exploration across the unknown country to the west of Hudson Bay, canoes for the trip were provided, and Mr. James W. Tyrrell, of Hamilton, Ontario, who had spent a winter among the Eskimos at Ashe Inlet, on the north side of Hudson Strait, and who spoke the language of that tribe of Eskimos with reasonable fluency, was secured as topographer and Eskimo interpreter. With the kind assistance of Mr. McLae Walbank, of Montreal, three Iroquois from Caughnawaga—Pierre, Louis, and Michel French—were engaged as canoemen. John Flett, a Loucheux half-breed, living at Prince Albert, Saskatchewan, was also engaged in the same capacity. Later on two additional canoemen were obtained at Fort McMurray, through the kindness of Mr. Henry Moberly, of Ile à la Crosse, Churchill River.

After making the necessary arrangements at Winnipeg with Mr. C. C. Chipman, Commissioner of the Hudson's Bay Company, for supplies to be obtained from any posts of the company, we proceeded by rail to Edmonton, and thence by team to Athabasca Landing, on the river of the same name. At the Landing, the steamer *Athabasca* was ready to start on her trip down the river, but as much of her freight had not yet arrived, I decided to go on with the two canoes, and a start was made on the evening of May 31st. The next three days

* Annual Report, Geol. Surv. Can., vol. VIII. (N.S.)

were occupied in descending the river to Grand Rapids. A day was spent there, the steamer having in the mean time arrived, and during the 7th, 8th and 9th of June, we descended the river to Fort McMurray, at the mouth of Clearwater River. Here we were joined by the two canoeemen from Ile à la Crosse with an additional canoe, and thenceforward our party consisted of eight men, all told, in three canoes.

Ft. Mc-
Murray.

The latitude of Fort McMurray was determined as $56^{\circ} 42' 56''$. After some detention, we left this place on the morning of 15th June, and towards evening of the same day, we met the Hudson's Bay Company's steamer *Grahame* ascending the river. Dr. McKay, who was in charge at Fort Chippewyan, was on board. He informed us that he had employed a Chippewyan named Moberly to go with us as far as the Barren Lands, that Moberly knew the route well and would probably be able to get another Indian to accompany him from Fond du Lac.

Ft. Chippewyan.

On the afternoon of June 17th, we reached the mouth of the river, and on the evening of the same day crossed Lake Athabasca to Fort Chippewyan, where observations were taken to rate the chronometer. Late on the evening of June 19th, the steamer *Grahame* arrived from Fort McMurray, with our supplies for the summer on board. The next day the steamer was unloaded, and our supplies, brought down by her, amounting to 2200 pounds, were made up in proper bales for portaging, any stuff that would be liable to be damaged by water being put in waterproof sacks. Letters, and photographs that had been taken up to that time, were left to be sent south on the next trip of the steamer up the river.

Begin survey
of Lake
Athabasca.

On the morning of 21st June, we left Fort Chippewyan, with our canoes loaded down to the gunwales, and started eastward along the north shore of Lake Athabasca, and as Moberly was not able to travel very fast with his family in their canoe, we found time to make a fairly accurate survey, with solar-compass and boat-log, of the north shore of Lake Athabasca. While travelling along by the north-west shore of the lake, we met Charlôt and a band of Indians travelling southward from their wintering ground on Charlôt River. We learned from them that there existed an excellent canoe-route up Charlôt River, across a height of land and down a stream into the south side of Great Slave Lake, or, instead of descending this latter stream to its mouth, a portage could be made to another stream that flows into unknown country towards the north, probably into the west branch of Doobaunt River, the mouth of which was found two months later.

Two days were lost on the shore of this lake on account of high winds, but on the morning of June 29th, we reached the now abandoned trading post of Fond du Lac. Here Moberly was to leave his family with some of his friends who were camped on the south shore. As soon as he reached their camp he, however, began to object to proceeding further, and it was only after long persuasion, and after we had agreed to hire, at extravagant wages, a friend of his to go along with him, that we were able to induce him to accompany us. But he positively refused to do any more work at the paddle that day. Accordingly we went a couple of miles, and camped for the night. The next day Moberly, and his friend Beauvais, caught up to us just before noon, and came slowly after us until evening, when we camped on a point nine miles west of the east end of the lake. Fond du Lac.

On the following morning we paddled to the east end of Lake Athabasca, where a couple of families of Indians were camped. Here Moberly and Beauvais, who had all along taken the post of rear-guard, rather than that of guides, went ashore, and lying on the beach, refused to go further until we should make a feast, distribute flour to the Indians here, and also leave some to be sent back to their families. With our limited supply of provisions, it was of course quite impossible to accede to these demands, and we, therefore, left them, and proceeded up Stone River, glad to be rid of the miserable fellows who had already caused us so much delay, and had done nothing for us but devour our provisions. Our guides leave us.

July the 3rd and 4th were occupied in crossing Woodcock portage, and on the evening of the latter day we camped on the beach of Middle Lake, at the north end of Elizabeth portage. July 5th and 6th, and the morning of the 7th, were spent carrying the canoes and cargo across Elizabeth portage, and at the same time, I made an examination of the heavy rapid north of the portage. On the afternoon of the 7th we paddled against a stiff head wind to the south end of the portage on the north shore of Black Lake, where we were to leave the country that we had explored in 1892, and to strike northward into the unknown territory between Stone River and the Arctic Ocean, guided only by a rude Indian map of the country as far as the head-waters of a stream that flowed northward into the land of the Eskimos and the musk-oxen. Portages west of Black Lake.
Leave the explored country.

On July 8th, most of the things were carried across this portage, which is two miles and a third in length, and on Sunday, the 9th, the men remained in camp on a hill overlooking a lovely little lake at the north end of the portage.

A day and a half at the beginning of the succeeding week, were spent travelling through a chain of small narrow lakes, lying in a valley be- Ascent of Chipman River.

tween steep rocky ridges. On Tuesday afternoon we entered Chipman Lake, and the time until the following afternoon was chiefly spent looking for Chipman River, which was found to flow into its northeastern side. The remainder of the week was spent ascending this river to its source in Selwyn Lake.

Cross the
height-of-
land.

On the evening of Monday, July 17th, we came on a small band of Chippewyan Indians camped near the north end of Selwyn Lake, at the foot of a hill, on the side of which birch bark could be obtained sufficiently large for canoes. These Indians did all in their power to dissuade our men from proceeding further, by describing the river ahead of us as being full of impassable rapids, and the country as swarming with cannibal Eskimos. However, on the following day they conducted us to the north end of the lake, where there is a portage, a mile and a quarter in length, across the height-of-land to Daly Lake, from which the river that we were destined to follow flows northward. The Indians would not accompany us north of the height-of-land, and most of the remainder of this week was occupied in following the shores of Daly Lake, though for one day we were prevented by high winds from launching our canoes. Shortly before noon, on Saturday, 22nd July, the Telzoa River, flowing from the lake, was discovered.

Descent of
Telzoa River.

Thence we continued down this stream, running most of the rapids. In searching our way through the irregular lakes we were obliged to climb most of the hills from which extensive views might be obtained, and to explore many deep bays which were found to have no other outlet than the one by which we had entered them. In this way a considerable tract of country came under observation, but progress was correspondingly slow. On July 27th, while crossing Boyd Lake, we passed from the wooded country into the Barren Lands, and on the 29th we met a vast herd of Barren-ground Caribou collected on a good feeding-ground on the eastern shore of Carey Lake. A number of these deer were shot, and the next few days were spent partially drying as much of the meat as we were able to carry with us.

Last grove of
spruce.

On the 6th of August what proved to be the last grove of timber on the river was passed, and on the 7th we entered Doobaunt Lake, which was found to be almost entirely covered with ice, although in most places there was a lane of water between the ice and the shore.

Detention in
Doobaunt
Lake.

Eleven days were spent in this lake, during five of which we were detained in camp by heavy storms. During the remaining six days the north-western and northern shores were carefully examined in the search for the outlet. The length of the shore-line measured was 117 miles, while the direct distance across the lake from the point where

the river enters it, to the point where it leaves it, is only 57 miles, or about two or three days' journey.

On the morning of the 18th of August the river was again entered as it flowed from the north end of Doobaunt Lake. After travelling swiftly down the stream for a few miles, we came to the wildest and most picturesque rapid on the river, where the water rushes for more than two miles through a deep crooked gorge, with a width of not more than twenty-five or thirty yards. Points of black pitchstone or red conglomerate project into the gorge, and as the water dashes against them it is hurled back in a mass of curling ever-moving spray. On the south east side of this rapid the canoes and cargo were carried for rather more than two miles and a half, over an open prairie country which, at the time, was very wet from the recent rains.

Outlet of the lake found.

On the evening of the 19th of August, about half way between Grant and Wharton lakes, we came to an Eskimo tent, occupied by a man, his two wives and five children. At first these people were in great consternation at seeing three canoes descending the river from the land of their hereditary enemies, the Chippewyans, but a present of a few trifles and a little tobacco put them fairly at their ease. The man informed us that it was still a long way to the sea, but that there were many Eskimos camped beside the river lower down, and that from them we should receive direction and assistance from time to time. He also said, that while there were still many heavy rapids on the river, the worst of all, and the one that would give us by far the most trouble, was near its mouth. This information proved to be very misleading, for we did not see any more Eskimos for two weeks, and the great rapid, that we were expecting to find at the mouth of the river turned out to be simply a long stretch of swift current down which the canoes were run easily and without danger, into the west end of Baker Lake. It is quite possible that the information, as given, was not intended to be misleading, but my brother, who acted as our interpreter, and who speaks the language of the Eskimos of Savage Islands with fluency, found it very difficult to understand the dialect spoken by these inland deer-hunting Eskimos, and so may have somewhat misconstrued the man's meaning. Our cook, who was said to have acted as Eskimo interpreter at one of the Hudson's Bay Company's trading stores near the mouth of Mackenzie River for eight years, could not understand this dialect at all.

Meet with Eskimos.

Report of many bad rapids ahead.

Difficulty in understanding this Eskimo dialect.

The direct course across Wharton Lake, from the point where the river enters it to where it leaves it again, is only twelve miles, but contrary winds obliged us to keep to the wrong shore, and detained

Contrary winds.

us in the lake for two days. Lady Marjorie Lake was also crossed in the teeth of a strong head wind, which constantly dashed the spray from the ice-cold water into our canoes and over us. As we descended the stream north-westward from Lady Marjorie Lake, the north-west wind continued to make travel very slow and wearisome. More than two days were spent on this portion of the river, and though all laboured manfully at the paddles, we were unable to travel as fast as the current was flowing in the middle of the stream.

Mouth of
Thelew River.

On the evening of the 25th of August, nineteen days after we had left the last grove of timber on the river above Doobaunt Lake, we reached the sandy plains at the mouth of a branch coming in from the west. Probably this stream is the Thelew River of Sir George Back, or the river described to me by Charlôt, a Chippewyan Indian, as being easily reached by ascending the Charlôt River from the north side of Lake Athabasca. On parts of these sandy plains was quite a rank growth of willow, and among the willows were scattered some large drifted tree-trunks. At our camp some of this wood was collected, and we not only enjoyed the luxury of a fire, but some bread was baked, and a large pot of meat was well boiled. Deer were fairly plentiful in the vicinity, and were shot from time to time in order to supply the party with fresh meat, but hunting was not allowed to interfere with the greatest possible expedition in travel. It had become evident that it would be possible to reach Churchill before winter only by travelling with the utmost speed. In order to gain this speed, and avoid the delay from the long portages which we expected still to reach, very little fresh meat was taken into the canoes at a time, and thus we assumed the risk of a shortness of provisions.

Some large
driftwood.

Necessity of
rapid travel.

From the mouth of Thelew River we turned eastward and travelled through Aberdeen and Schultz lakes, one day being lost in the former lake searching for the outlet. On August 30th, when on the river a short distance below Schultz Lake, we were overtaken by a heavy storm, and, until the morning of the 2nd September, we were unable to launch the canoes. On the latter date we ran down the river to the west end of Baker Lake, which had previously been visited by white men, and which we recognized with great pleasure, for it put an end to our uncertainty as to whether we were travelling towards the Arctic Ocean or towards Hudson Bay, and we had not encountered the long dangerous rapid that we had been looking for. We now wished, if possible, to obtain a supply of caribou-meat, but unfortunately the caribou had become very scarce, having probably withdrawn from the shore into the interior.

Reach a point
previously
visited by
white men.

The survey with compass and boat-log was continued eastward along the north shore of Baker Lake, though for two days we were detained by a storm at the mouth of Prince River. On September 7th we reached the head of Chesterfield Inlet, a long narrow fiord stretching into the very heart of the Barren Lands from the west coast of Hudson Bay. Thereafter in the tidal water of the inlet and along the west coast of the bay, the boat-log was of little or no service, and the distances were, therefore, estimated from the rate of travel. The mouth of the inlet was reached on the 12th of September, and the day being clear, excellent observations were obtained, both for latitude and longitude.

Chesterfield Inlet.

The next three days were beautifully fine and mild, and we made good progress southward down the shore, passing Marble Island, which rose as a vast white dome out of the smooth blue-green water. Towards evening of September 15th, a wind sprang up from the south-east, and drove us ashore on a small sandy island on the north side of Corbett's Inlet, in latitude $62^{\circ} 30' 00''$, where we were detained for two days.

Pass Marble Island.

On the 17th of September, the south-west wind went down, and we crossed the mouth of Corbett's Inlet, but before we had reached the southern shore a heavy gale sprang up from the north-west, and our little canoes were almost swamped as we approached the shore. All the coolness and dexterity of our good canoe-men were called into play in guiding the canoes through and between the breakers into the quiet water behind the rocky reefs. The storm continued to rage, and we were obliged to remain for three days on the point south of Corbett's Inlet, by which time the fresh-water ponds were covered with ice more than three-quarters of an inch thick.

Dangerous crossing of Corbett's Inlet.

The 20th and 21st of September were sufficiently fine to allow us to paddle across Pistol and Mistake bays, at times keeping close to the rocky shore, and at times being miles from land out in the middle of the bays or inlets. The existing maps or charts were of little or no service in guiding us, so that we were obliged to follow the curvings of the shore, or shape our course from headland to headland, being quite unable to take advantage of inside channels, if any such exist.

Previous maps of no service.

On the evening of the 21st we camped on the north side of Neville's Bay. During the night a north-east gale set in, and on the following morning it was driving before it a heavy fall of snow. The barometer dropped about an inch that day, and the storm continued to rage for four days, accompanied by snow, sleet and rain. On the fourth day we walked over the hard crusted snow to the mouth of Ferguson River, which was afterwards descended in 1894. The provisions that we had brought with us were now exhausted, and henceforward we were obliged to depend on our guns for food.

Winter

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On September 26th, although the weather was still rough and cold, and the thermometer was constantly below freezing point, the canoes were again launched, and we paddled across the mouth of Neville's Bay, around the rocky point to the south of it, and across Dawson Inlet, to a low sandy shore near the mouth of Wallace River, where we were again detained for a day by heavy seas. During that day five ground squirrels were shot.

On 28th September, after having made a breakfast of the ground squirrels shot the day before, we again started southward, and travelled a few miles. Some caribou were then seen on the shore, and we immediately landed to hunt them, and though unsuccessful in this, one of the men shot a polar bear, and thus furnished us with a considerable supply of food. Another storm now set in and continued to rage for five days, accompanied by a heavy fall of snow, so that the lichens, or dwarf ~~bush~~, on which we had depended for fuel, were buried out of sight, and the shore, above high-tide mark, was covered with eighteen inches of snow and ice.

Polar bear
shot.

Want of fuel.

Flat ice-
covered shore.

On October 4th the canoes were again launched, by carrying them out half a mile over the flat ice-covered shore to meet the tide. During the day we paddled about ten miles against a south-west wind, which all the time drove a light snow in our faces, and camped on a very low shore in latitude $61^{\circ} 31' 10''$, having been obliged to carry everything half a mile over the flat shore to the land above high-water mark. October 5th was cold and clear, the thermometer at noon standing $26^{\circ} F$. We travelled two miles and were then driven ashore by rough weather.

Impossibility
of reaching
Churchill with
loaded canoes.

It had now become evident that we should be quite unable to reach Churchill, which was still 260 miles distant, on open water with our three canoes and their cargo of collections made during the summer. It was, therefore, decided to leave everything behind which was not absolutely necessary for the safety of the party, and thus lightened, to push forward with all possible speed. The land was a vast snow-covered treeless plain, but a slight gravelly eminence was chosen, half a mile from high-tide mark, and on it one canoe, all our rock specimens, instruments, and whatever else was not necessary for our existence, were carefully piled in a heap, covered with tarpaulins, and weighted down with heavy stones. The note-books, photographs, and collection of plants, with axes, guns, ammunition, blankets and two tents, were placed in the remaining two canoes. Thus lightened, with four men paddling in each canoe, we again started southward, determined to travel as far as possible by water.

Collections,
instruments,
&c., cached on
the shore.

The shore was flat, with a tide of from twelve to fourteen feet, and at ebb tide the water was usually several miles distant from the line reached by it at flood tide, so that we were unable to land or launch the canoes more than once in twelve hours—at the time of flood tide.

Wide tidal shore.

For ten days we struggled onward in the canoes, living on what sea ducks could be shot over the open water. The weather was cold, and the spray that was dashed over us by the wind froze on our clothes and beards. It was necessary to constantly knock the ice from the paddles, or otherwise they would soon become too heavy to swing. In places a bordage of ice had formed in front of the beach, so that it was impossible to reach the land with the canoes. The floating ice, through which it was often necessary to push the canoes, had cut them badly and rendered them very leaky. By this time one of the men was suffering severely from an attack of dysentery, and was unable to take his place at the paddle.

Canoe journey continued.

Canoes cut by floating ice.

At nightfall, on October 14th, the tide was at its ebb, and the canoes were several miles from land, off the mouth of Paukathakuskow River, in the midst of heavy drifting ice. The night was spent in the canoes, and one of the men had both his feet badly frozen. At flood tide, shortly after noon on the following day, the edge of the solid ice was reached, and the canoes were drawn over it to the shore. It was impossible to put them again into the water, as that night the shore became covered with compact ice for a long distance out. It was afterwards learned that the Hudson's Bay Company's officer at Churchill had left a boat on the shore between York and Churchill, several weeks before, considering it too late to continue the journey to Churchill that season.

End of canoe journey of 1893.

From the mouth of Paukathakuskow River two men were sent on foot along the shore to Churchill, where they were able to obtain four sledges and teams of dogs, and with the assistance of these dog-teams the canoes and party were hauled over the snow to Churchill, where we arrived on October 19th.

Churchill reached with dogs and sledges.

On the 6th of November, the Churchill River was frozen over, and having obtained a sledge and team of dogs, to haul the provisions as well as the man whose feet had been frozen, the overland journey to Winnipeg, a distance of about 900 miles by the proposed line of travel, was begun.

Start from Churchill for Winnipeg.

On arriving at Nelson River, the stream was found to be full of running ice, so that it was impossible to cross it, either in a boat or on the ice. Our party, augmented by three local Indians, was therefore obliged to remain on its banks for ten days, subsisting on the few

Delay at Nelson River

rabbits, ptarmigan, foxes, &c., that we were able to catch or shoot. During this time the weather was very cold, the temperature often falling at night to -20° F. On November 24th, however, we arrived at York Factory, and on the 28th of the same month we left the inhospitable shore of Hudson Bay, and travelled by way of Oxford House and Norway House to West Selkirk, Manitoba, where we arrived on the evening of January 1st, 1894.

Arrive at
Selkirk.

Work of 1894. On the 28th of May, 1894, the writer was instructed to further explore the Barren Lands west of Hudson Bay. Information had been received during the two previous years, that a passable canoe-route existed from Reindeer Lake northward up Cochrane River, across a height-of-land to Kasba or White Partridge Lake, and thence north-eastward down the Kazan or White Partridge River to Hudson Bay; and it was certain that as the river was south and east of the Telzoa or Doobaunt River, its mouth must be somewhere between the head of Chesterfield Inlet and Churchill. What little information had been received had led to the belief that it was the river which we had seen flowing into the bottom of Neville's Bay. This proved to be an error, and it is now reasonably certain that the Kazan River discharges into the south side of Baker Lake.

Mr. R. Munro-Ferguson.

On this occasion, the writer was accompanied by Mr. R. Munro-Ferguson, A.D.C. to His Excellency the Governor General of Canada, with his own canoe and men, and entirely at his own expense. Mr. Ferguson also supplied the party with several instruments, and throughout the whole season did everything in his power to advance the interests of the expedition. Its complete success is largely due to his constant and enthusiastic energy and assistance.

Preparation
and assist-
ance.

Two cedar canoes, built specially at Peterborough, Ontario, were provided, and with the kind assistance of Mr. Wm. Clark, of Winnipeg, and Mr. McLean, of St. Peter's, three canoeemen, Roderick Thomas, John Harper and John James Flett, were employed at Selkirk, Manitoba, while a fourth man was engaged as cook and canoeeman in Winnipeg. Sir John Schultz, Lieutenant Governor of Manitoba, also kindly loaned us a large birch-bark canoe to assist us in carrying provisions during the earlier part of the trip. Arrangements were also made with Mr. C. C. Chipman, Commissioner of the Hudson's Bay Company, for obtaining any additional supplies that might be needed from the trading stores of the company if the articles were not wanted for their own use. A supply of provisions was also purchased and sent up to Fort Churchill, on Hudson's Bay, by the Hudson's Bay Company's steamer "Erik," to serve on the return trip, or in the event of being delayed at Churchill.

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With these arrangements made, and with ten weeks' provisions, the party started from Selkirk on June 16th, but it was the 22nd of June before it reached Grand Rapids, at the mouth of the Saskatchewan River. Here the canoes were put in the water for the first time, and two additional men were employed to man the birch-bark canoe, and accompany us up the river as far as Cumberland House, which was reached on July 2nd. On the way we were delayed for two days by a heavy storm, and our progress was greatly retarded by the rapid current of the river, which at that season of the year was at extreme high water.

Leave Selkirk.

Unfortunately some of our provisions had been lost by the upsetting of one of our canoes in the Calico Rapids below Cedar Lake, but we were able to replace most of them at Cumberland House. David Crane, a Cree Indian, was engaged as canoe-man to replace the cook employed in Winnipeg who had proved inefficient; and two other Indians were engaged to accompany us in the birch-bark canoe as far as Du Brochet post at the north end of Reindeer Lake, from which place they were to return. The two men employed at Grand Rapids returned from here.

Arrive at
Cumberland.

On July 4th, the party left the Saskatchewan River at Cumberland, and turned northward up Sturgeon-weir River to Churchill River at Frog Portage, thence down the Churchill River a few miles to where it is joined by Reindeer River, up this stream to Reindeer Lake and along the eastern shore of Reindeer Lake to its northern end, where the Hudson's Bay Company have their most northerly trading post in that district, and the Roman Catholic Church has a mission. Here the Chippewyan Indians resort from the surrounding country two or three times a year to barter their fur and deer meat for ammunition and clothing, and to perform their devotional exercises. About Christmas time a few Eskimos come in from the far north bringing robes and furs to trade for ammunition and tobacco, but throughout the remainder of the year the trader and the missionary are almost alone.

Du Brochet
Post.

At this place, which is usually called Du Brochet post, the two Indians whom we had engaged at Cumberland were sent back in the bark canoe, and two Chippewyan Indians were persuaded to accompany us northward in their own canoe as far as Ennadai Lake on the Kazan River, as guides, and to help us to carry our provisions.

Engage two
Indian guides.

Up to the time of our arrival at Du Brochet post, we had been travelling through country which was already to some extent known, at least geographically, and we had therefore hurried on, devoting all

Extent of
previous sur-
veys.

the time caused by necessary delays to an inspection of the adjoining rocks and not to the making of any regular geographical survey. The position of Du Brochet post had been moderately well determined by the surveys of Mr. A. C. Cochrane in 1881 and Mr. D. B. Dowling in 1892. The first-named gentleman had ascended Cochrane River, following the route we were about to travel, for one hundred and fifteen miles, but his distances were all estimated, and on this river he took no astronomical observations for either latitude or the variations of the compass, so that it was necessary to commence the survey from this trading post.

Surveys
begun.

Observations were, therefore, taken for latitude and the variation of the compass, and on the afternoon of July 20th we left this last abode of civilized man and began the ascent of Cochrane River, measuring the quiet stretches with a boat-log and estimating the stretches of running water, taking the bearings with a prismatic compass, using a solar compass occasionally to correct the variations, and taking the latitude daily, when possible, with the sextant. The river was ascended in a general northerly direction for a hundred and twenty-one miles, in which distance there were nine portages, to a point on its east bank, where the Indians usually leave the stream and carry their canoes over a steep-sided sandy ridge for a third of a mile to a small lake.

Long chain of
portages.

On the afternoon July 27th, we left Cochrane River and carried our canoes, provisions and supplies across this portage, which proved to be the first of a long chain of portages, forty-four in number, with an aggregate length of about thirteen miles. The trails were usually very bad, being often over irregular masses of broken rock, and, as a rule, it was necessary to make four trips over each portage to carry the canoes and their loads. This route passes through many lakelets and down and up small streams tributary to Thlewiaza River, till it finally reaches Kasba Lake, on the sandy shore of which we had the pleasure of camping on the evening of August 5th.

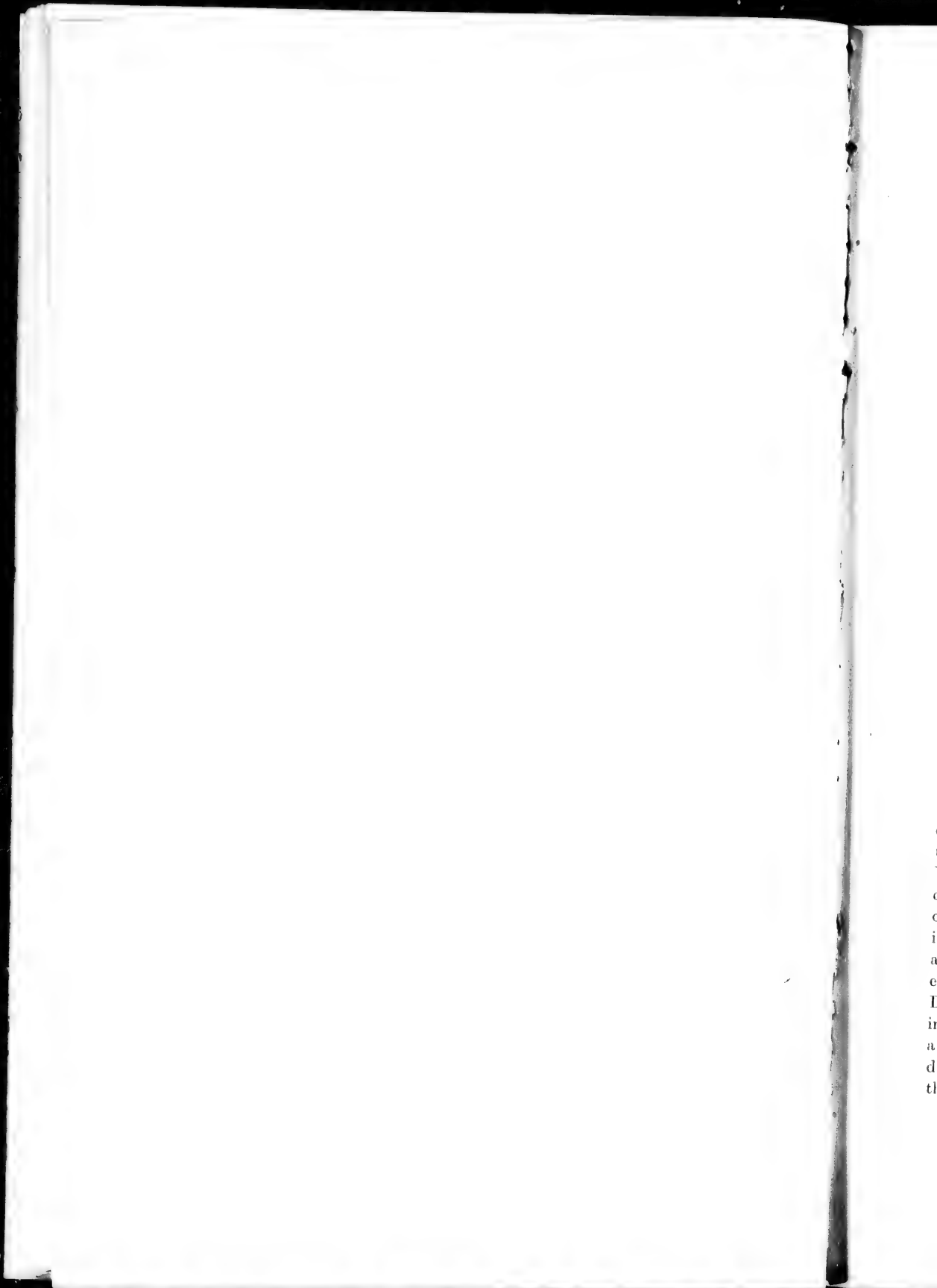
Begin the
descent of
Kazan River.

A storm now delayed us for a day and a half, but on the 7th of August, we were able to launch our canoes on this lovely sheet of clear water, and begin the survey of its eastern shore. With considerable difficulty we induced our Chippewyan guides to accompany us through this lake, and down the Kazan River, which flows from it, for thirty miles to the south end of Ennadai Lake. These Indians had now done all that they had originally agreed to do in taking us down the Kazan River as far as they had any knowledge of the country, either from their own experience, or from the accounts of their friends. We had reached the



J. B. TYBELL.—Photo, Aug. 18, 1894.

ESKIMO CAMP ON THE BARREN LANDS.



northern confines of their hunting grounds, and the unknown country to the north was supposed to be thickly peopled with unfriendly Eskimos.

On the morning of August 10th, therefore, we paid them for their services, and continued northward over Ennadai Lake without them. Indian guides return south.

The party now consisted of Mr. Munro-Ferguson and the writer, with four canoe-men, in the two cedar canoes. An unknown river, with many broad lakes, lay between us and some point on the west side of Hudson Bay, beyond which was the canoe journey in autumn down the inhospitable, treeless shore, of the bay itself.

After paddling thirty miles down this lake, we were delayed for two days by a heavy storm with snow and rain, where the tents had been pitched in the second camp beyond the northern edge of the woods. Storm on Ennadai Lake. Up to this time we had not seen any caribou, and had not been able to shoot anything with which to replenish our rapidly diminishing stock of provisions.

On August 14th, we crossed to the west side of Ennadai Lake, and then, for the first time that season, fell in with the Barren-ground caribou, travelling southward in large numbers. Barren-ground caribou. The country was open and treeless, and the deer were rather difficult to approach, but twelve were shot and cut up, and their meat was spread out to dry in the sun and wind.

Here a Chippewyan Indian came into our camp and gave us to understand that many Eskimos were camped farther down the river. An Indian wanderer. After considerable persuasion, he consented to guide us down to where the Eskimos were living, but the next day he left us, and we saw nothing more of him. We, therefore, continued down the river without any guide until the afternoon of August 17th, when we reached the Eskimo camp of Kopanuak, so called after its chief man. On our approach, the inhabitants fled away over the hills, but after a while they became convinced of our friendly intentions, and slowly returned. Meet with Eskimos. We now felt very keenly the need of an interpreter, for none of us could speak their language, and they could not understand a word of ours. However, after considerable difficulty, one of the Eskimos was induced to draw a rough map of the lower part of the river, which appeared to show that it flowed through several large lakes and then emptied into the west side of Hudson Bay, south of Marble Island. Delighted with this information, and accompanied by three Eskimos in their deer-skin kyacks we continued down the river to the tent of a bald old man named Hikuatuak, where we camped for the night, drenched to the skin by a drizzling rain which had been falling during the afternoon.

Companions. The next day the Eskimos accompanied us, attracted by the small presents of needles, tobacco, &c., that we were able to make to them, and by the novel sight of white men journeying through their country. Two camps were passed, and towards evening we reached a third, consisting of two tents, inhabited by four families or about sixteen persons. Hallo was the chief man, but two others were Ah-yout and his son Kakkuk.

An Eskimo guide secured. We had still to descend about a thousand feet before reaching sea-level, and it was therefore probable that many rapids or falls lay between us and Hudson Bay, while much time might be lost in searching our way through the irregular lakes. It was therefore necessary, if the journey was to be continued, that a guide should be secured. At length, after a long parley, the promise of a gun to himself, and tobacco, beads and knives to many of his relatives, induced Kakkuk to accompany us, while his father, Ah-yout, said that he would go a short distance with his son. The next night Ah-yout volunteered the pleasing intelligence that he would go with us all the way to the sea. We continued down the river, almost every day passing two or three small Eskimo camps, where we were always welcomed kindly, and our presents of tobacco, &c., were received with shouts of joy. With needles, thimbles, &c., we purchased deer-skin clothing to protect ourselves against the severity of the autumn weather which was now so nearly upon us.

Unwelcome news about the river.

On August 26th we reached Passamut's camp, where it was learned for the first time that the river that we were descending emptied into Chesterfield Inlet. To follow the river there would be out of the question, for we would probably reach the Inlet even later than in the previous year, and on the trip down the shore of Hudson Bay, we should be exposed to the same dangers and privations that we had then suffered. After making diligent inquiries, however, we learned that it was possible to leave the Kazan River some distance below, and by a chain of long portages to reach a lake at the head of another stream which empties into Hudson Bay opposite the Walrus Islands. We determined to try this route.

Another route.

Leave Kazan River.

On the 30th and 31st of August we crossed Hicoliguah Lake, doubtless the Yath-kyed Lake of Samuel Hearne, and reached an Eskimo camp below it, near the point where we were to leave the river. Six more Eskimos were hired to help us across the portages, one of them agreeing to accompany us to the sea, for our two guides did not know the way any further. The first of September was beautifully fine, giving us the opportunity of obtaining good observations for latitude and

variation, the former being $63^{\circ} 7' 48''$, and the latter $20^{\circ} 45'$ east. After this rainy and stormy weather set in. For most of five days the men worked ankle-deep in the water on the wet portages. On the 5th of September we reached Ferguson Lake, five of the Eskimos were paid off, and from that time until September 18th, when we reached Hudson Bay, the weather was constantly stormy, with showers of rain and snow. The Eskimos shot reindeer and supplied us with meat, but very little fuel was to be had to cook it with. At Hudson Bay our Eskimo guides were paid off and we parted with them with great regret, for in the month that they had been with us we had all become excellent friends.

On reaching the mouth of the river we at once recognized it as a Reach Hudson Bay. place to which we had walked through the deep snow on September 25th, 1893, when storm-bound on a point a few miles distant at the mouth of Neville's Bay. From the time of our arrival at that camp it had then taken us twenty-eight days to reach Churchill. Should the weather prove similar to that of last year, and cause us similar delays, many and great hardships were undoubtedly again in store for us. But the day was calm, and while our three Eskimo friends turned back up the river, we paddled out with the tide over the salt water of Hudson Bay, camping for the night on a bold rocky point a few miles south of Sir Bibby Island.

The next day a stiff south wind with a heavy fall of snow, rendered our progress very slow, but at length we succeeded in crossing Dawson Inlet and reaching the point near the mouth of Wallace River where we had camped on the 26th of September the previous year. After cutting a hole through the ice of the small lake in the vicinity, the water was found to be now quite blackish, and we were, therefore, obliged to melt some snow over the alcohol lamp for tea. The next day, 20th September, the south wind was still blowing, causing heavy breakers on the low sandy shore, but we carried our canoes and cargo a few hundred yards along the shore and managed to launch the canoes behind a bar of sand. The ebbing tide, and low shore with its very long points of boulders, obliged us to keep far out from land. When the tide rose again we landed, probably a short distance north of our *ciche* of last year, but it was now after dark and we could see nothing of the adjoining country. The next morning was cold and cloudy, with a south-east wind. Leaving Mr. Munro-Ferguson to launch the canoes and bring them on as soon as the tide should rise sufficiently high, the writer walked along the shore to look for the *ciche*. The small ponds were all frozen over, but the brooks were still open except along their edges. After walking for a couple of hours, without seeing any signs of the

Canoe journey along the shore.

câche, the canoes came up. The tide was now ebbing fast, and it was necessary to join the canoes at once and travel on, leaving the shore altogether, or to land the canoes for the day.

Delay inadvisable.

For the past three weeks the sky had been constantly overcast, so that no astronomical observations could be taken to determine our position, and for five days out of the past seven, it had been snowing more or less every day. As the subarctic winter was rapidly closing round us, and we were still two hundred and sixty miles from Fort Churchill, the nearest base of supplies, on an uninhabited barren coast, with no fuel but three pints of alcohol, it seemed very unwise to lose even a day's travel in a search for the *câche*; more especially so, as we should have been able to take very little, if any, of the stuff with us, for our collections and necessary provisions furnished our two canoes with nearly all the loads that they could carry. We, therefore, continued our journey, camping at high tide, long after dark, on a sandy flat below spring-tide level, about seven miles north north-west from Cape Esquimaux.

Left aground by the ebbing tide.

The next day we travelled about eleven miles, being finally driven ashore in a storm on a small sandy island on which there was no water. On the day following we travelled about sixteen miles. The tide was at its height shortly before noon, but we continued in our canoes till after two o'clock, when finding that the tide was ebbing very fast, we turned towards shore, but were unable to come within a mile and a quarter of land when we went aground on the sand and boulders. The canoes and stuff were then portaged for the above distance to a small island, where the camp was pitched, trusting that an east wind would not arise in the night and drive the rising tide over us. The water around us was found to be fresh, and further investigation proved that we were camped in the mouth of a river, probably of considerable size. The night was starry and cold, and an observation showed us to be in latitude $60^{\circ} 49' 45''$. At low tide the sea could not be seen from our camp.

Water frozen around the tents.

The next morning the water was frozen all around the tents. The canoes were carried a third of a mile to meet the incoming tide, and we were afloat an hour and a half before the tide was at its height. That day, in spite of a snow storm, we made eight miles along a low shore, often through thin floating ice, going ashore, as the tide went out, on a sand spit in front of the mouth of a small brook.

The next day, 25th September, the canoes and stuff were carried out on the flat shore, and the tide was met nearly three hours before it was at flood, and in spite of a stiff south-west wind right in our faces,

we travelled ten miles to a rocky knoll, where we camped about a foot and a half above the last flood tide, separated from the low shore by a quarter of a mile of sandy tidal flat. Opposite us was the mouth of a small brook, from which we obtained water. Our object in camping on this little rock was to be able to catch the tide in the morning, for it would be up about four o'clock, long before the first streak of dawn appeared at that time of year. The next morning was perfectly calm, and we had launched our canoes by half past four, but at six o'clock a dense fog set in, and continued almost all morning, covering the canoes and everything in them thickly with frost crystals. Many times the canoes were in danger of destruction from cakes of floating ice, or from being carried over boulders by the swiftly ebbing tide. Lunch was eaten in the canoes, and a long day's travel of about thirty-five miles was made, camp being pitched for the night in the bottom of a bay full of boulders. The next day was clear, cold and windy, the thermometer standing at 26 Fahrenheit at noon, when an observation was obtained showing the latitude to be $60^{\circ} 3' 30''$. On a light rise a short distance back from the shore the men found some drifted tree-trunks, being the first large driftwood that we had seen this autumn on the west coast of the bay. Towards evening the wind went down a little and we travelled southward for four miles to a stony hill, where two large drifted logs gave us the promise of a good warm fire, a luxury that we had not enjoyed for many a day.

The next morning we launched our canoes at high tide and shoved through the thin ice among the boulders by the shore. The weather was cold throughout the day, the ice forming constantly on our paddles, but we carried some firewood in our canoes, and at noon, when the tide was down, we came to a rock where we were able to build a fire and have a hot lunch, and at night our camp was pitched on a point in latitude $59^{\circ} 28' 8''$, where driftwood was very abundant, and we had a splendid fire. On September 29th the wind prevented us from going past Hubbard Point, having travelled only eight miles, and our camp was pitched on the stony hill at the point. In the afternoon the men paddled to the shore, about a mile to the west, and procured some water.

September 30th was dull and either calm or with a light breeze from the north, and good progress was made. At night-fall we were opposite the mouth of Paukathakuskow River, where we went ashore for the last time last year. The tide was not yet up, and we experienced considerable difficulty getting to land through and over the thick ice, finally reaching a willow-covered flat, where our tents were pitched in the snow. The next morning we continued to follow the shore for about five miles

Camp on rocky knoll.

Travel in the fog.

First driftwood.

Difficult navigation.

Reach Hubbard Point.

Arrive at
Churchill.

Work at
Churchill.

Preparations
for overland
journey.

and then, as the Churchill rocks began to appear on the horizon, we struck across the mouth of Button's Bay and rounded the outer Churchill beacon at noon. The tide was rushing out of the gap at the mouth of the harbour, and we were, therefore, unable to enter it until the tide had turned. About four o'clock we passed old Fort Prince of Wales and entered the harbour, and just as night settled down on us we landed on the rocky point below the mission at Churchill. Here we were met by Reverend Mr. Lofthouse, Capt. Hawes and Mr. Alston and given a hearty welcome. It was impossible to proceed further with canoes, and, as the rivers were not yet frozen, it was equally impossible to travel overland. We, therefore, accepted the very kind invitation of Mr. and Mrs. Lofthouse to stay with them during our necessary detention at Churchill, while Capt. Hawes provided a room for the men in one of the houses at the trading post. During our detention here, which was protracted through nearly two months, the rocks of the vicinity were examined as closely as possible, the surveys already made were plotted on a scale of two miles to an inch, considerable information was collected as to the dates of opening and closing of Churchill harbour during the past seventy years. Sketches and descriptions of the country lying west of Hudson Bay and east of Reindeer Lake and Kazan River were also obtained from an Eskimo named Powow who was spending the winter at Churchill, and from Jimmy Anderson and Curly Head, two Chippewyan Indians who came in to trade.

In 1893 we had returned southward from Churchill by following the route used by the Hudson's Bay Company to York Factory, and thence to Oxford and Norway House. This year we decided to explore a new route, going direct from Churchill to Split Lake on the Nelson River, and thence by Cross Lake to Norway House, a route especially interesting as being near the proposed line of the Hudson Bay railway; but there was no trail across the country from Churchill to Split Lake, for the route had never been travelled, and the Hudson's Bay Company's officer at Churchill was unwilling to risk the starvation of his men and dogs by sending them that way. On November 10th the Churchill River froze over, but we were obliged to wait until the 22nd, when eight Chippewyans came in to trade, before we could obtain dogs. From these Indians we bought five dogs and a dog-sled. Two Cree Indians, named James Wastascot and David Dick, were at that time camping in the vicinity, and as food was very scarce, we induced them to accompany us to Split Lake with their dog-sled and team of three dogs. The Hudson's Bay Company also agreed to send a dog-team and two men with us for the first six days of our journey. The Geological

Survey canoe was stored at Churchill and most of the collections and heavy stuff were left to be brought out of Hudson Bay the following year by the annual ship of the Hudson's Bay Company.

Being now provided with means of transport, the loads, consisting Provisions, almost entirely of provisions, bedding, guns and ammunition, were &c. made up and packed on the sleds. Fourteen days' rations were taken for the men and twelve for the dogs, the latter consisting of refuse meat from the white whales or belugas that had been caught in the harbour during the summer. The total weight of the provisions was a thousand pounds, four hundred being for the men and six hundred for the dogs.

At day-break, on the morning of Wednesday, the 28th of November, we bade goodbye to our kind friends and started up the Churchill River on our long tramp homeward. That day we walked without snow-shoes on the ice of the river, but early the next day we left the river to the west of us, and, tying on our snow-shoes, started across an almost treeless snow-covered plain, through which Deer River winds in a very sinuous channel. On the fifth day the edge of the woods was reached, and from that time the snow was very soft and deep. On the night of the 3rd of December camp was pitched on the brow of a high ridge, which was said to extend a long way both to the north and south. Here the Hudson's Bay Company's dog team and two men left us and returned to Churchill, while we continued southward with our own team and that of our two Indians, chopping our way through the forest. Our course led us across the head-waters of Owl River, which flows into Hudson Bay a short distance north of Nelson River. On December 9th we reached Wapinihik'iskow or White Spruce Lake, at the head of the Kisse'-mitiskun or Old Fish-weir River, a tributary of Nelson River, and the same evening we reached Namaco Lake, at the head of Mittitto or Limestone River, where we found a small band of Indians camped for the winter. Our dog food was almost exhausted, and here we not only obtained a supply of fish for our dogs, but we induced one of the Indians to accompany us with his dog-team to Split Lake, where he was accustomed to trade his furs. The rest of our route was therefore comparatively easy, for we had the assistance of a guide, a fresh team of dogs and a well cleared trail, though the trail was now covered deep with soft snow. On the evening of 13th December we reached the bank of Nelson River, a short distance from Gull Rapids, and ascending the river we reached the Hudson's Bay Company's trading post on Split Lake on the morning of the 15th of December, the eighteenth day out from Churchill.

Start for Split Lake.

General course.

Reach Nelson River.

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Here we paid off our Indian companions, who were to return to Churchill and Namaco Lake, and hired another man and dog-team to accompany us to Norway House, which place we reached on Christmas Eve, after an eight days' walk. There four days were spent under Mr. Macdonald's hospitable roof, giving both men and dogs a much needed rest. David Crane, one of our steersmen, who had accompanied us throughout the summer, was here paid off, and sent home to Cumberland by Grand Rapids and up the Saskatchewan River. Then, after hiring a fresh dog team, we again started southward on the 29th of December, and walking on the shore of Lake Winnipeg, reached Dog Head on the evening of the January 4th. The dogs from Norway House had already returned, and here the dog-team purchased at Churchill was disposed of. At length, leaving aside our snowshoes, we obtained two carioles and one sled, with three teams of dogs, to take us to Drunken Point, where we hired horse-teams to take us to Selkirk. That town was reached on the evening of January 7th, after an absence of six months and twenty-two days, during which time we had travelled 2900 miles, 1750 of which was in canoes and 725 on snowshoes.

HISTORICAL SKETCH.

Reasons for former want of knowledge about this country.

The country here reported on has up to the present remained essentially unexplored, for in it valuable fur-bearing animals are scarce or in most places almost entirely wanting, and fur-traders have, therefore, not penetrated into it, become familiar with its waterways, or marked out its portages. Its lakes, streams, and mountains have remained unknown except from the vague stories that have been brought into the Hudson's Bay Company's trading posts on Churchill River, or on Great Slave, Athabasca or Reindeer lakes. No trading posts had ever been established in it, and its beauties and dangers were wrapped in the deepest mystery. North of the limit of the woods it had never been crossed by civilized man, and only once had any attempt been made to penetrate into it.

Copper reported.

Hudson's Bay Co. censured.

Samuel Hearne.

During the last century many reports were brought to Churchill, on Hudson Bay, of the existence of great quantities of native copper on the banks of a stream far to the north, and about the same time the Hudson's Bay Company was subjected to severe criticism and violent censure in England on account of the constant assertions, and growing belief, that the Company was strongly opposed to any investigation or exploration of the interior country, back from the shores of Hudson Bay.

Accordingly Samuel Hearne, a clerk at Fort Prince of Wales, the stone fortress at the mouth of Churchill River, was sent with some

Indians on foot, in the autumn of 1769, to look for the Coppermine River, and the deposit of ore on its banks.* He went but a short distance up Seal River, when the Indians deserted him and he was obliged to return, having been absent thirty-six days. 1st Journey, 1769.

On the 23rd of February, 1770, he again started from Fort Prince of Wales, and travelled westward to Lake Sheth-than-nee, or Sheth-nanei (the high hill) where he remained for the winter. In the spring he began his journey northward, and reached Baralzone, near the edge of the woods, on June 1st. Continuing onward he crossed some lakes and streams at the head of the Tha-anné and Maguse rivers, and on June 30th arrived on the banks of the Kazan River above Yath-kyed Lake, at a place which he calls Cathawhachaga, only a short day's journey south of a bay of Yath-kyed Lake. Since a number of Indians were collected at this point to kill caribou as they attempted to cross the river, it was probably the regular deer-crossing place above Yath-kyed Lake, known to the Eskimos as Pal-lel'-lue. Hearne's astronomical observations are here seen to be very inaccurate for he states "I made several observations for the latitude, and found it to be 63° 4' north," whereas the river flows into Yath-kyed Lake from the south-west about latitude 62° 38', and the crossing-place is a couple of minutes further south, leaving the mean of his "several observations" about 28' too far north. 2nd Journey, 1770.
Cathawhachaga.

From Yath-kyed Lake he accompanied a large band of Indians as they wandered backward and forward in search of caribou, working very slowly towards the north-west, around the north side of Doobaunt Lake, until the season became so far advanced that his guide refused to go through to the Coppermine River that year. The Indians with whom he was travelling also plundered him of almost all that he had in his possession, and to complete his discomfiture his sextant had been blown over by the wind and shattered. He, therefore, decided to return to Churchill. Keeping to the west of Doobaunt Lake, he appears to have crossed the Telzoa River a short distance above it, perhaps at the bluff of small black spruce where we camped on the 6th of August, 1893, and the Kazan River a short distance above Angikuni Lake. On 25th October he reached the edge of the woods. The day before he reached Seal River he crossed an exceedingly stony piece of ground, possibly of a morainic character. On November 25th, he arrived at Fort Prince of Wales, "after having been absent eight months and twenty-two days, on a fruitless or at least unsuccessful journey."

Plundered by his Indian guides.

His return.

* A journey from Prince of Wales Fort, in Hudson Bay, to the Northern Ocean, by Samuel Hearne, Dublin, 1796.

3rd Journey,
1770-1772.

Twelve days afterwards, having obtained new guides, he again set out for the Coppermine River, but on this occasion he avoided the Barren Lands as much as possible. Starting from the fort, over the snow, with dogs and sledges, he reached Seal River on December 13th, and on the 30th of the same month arrived at Island Lake. In the beginning of February, 1771, he crossed Kasba or White Partridge Lake near its northern end, and a month later Whooldyah'd Lake, which is possibly the one here called Daly Lake, though it is almost equally likely to be one of the many adjoining lakes. He continued westward to a place called Tholewey-aza-yeth, or Little Fish Hill, somewhere north of Lake Athabasca. Here he turned northward, and, passing near the east end of Great Slave Lake, reached Coppermine River on the 15th of July. On his return journey, he followed much the same course from Tholewey-aza-yeth to Churchill.

Remarks on
Hearne's
work.

Of the recent state of our knowledge of this country, Dr. G. M. Dawson, Director of the Geological Survey, speaks as follows:—"The lakes and rivers shown in this great region depend entirely on the results of the three journeys made by Hearne in 1769-1772. Hearne really wandered through parts of this region in company with Indians whom he was unable to control, his ultimate object (which he at length accomplished) being to reach the Coppermine River, in order to ascertain, for the Hudson's Bay Company, whether it was possible to utilize the native copper found there. Not even roughly approximate accuracy can be assigned to his geographical work. Referring to the position of the mouth of the Coppermine, he writes: 'The latitude may be depended on to within 20 miles at the utmost.' In reality it afterwards proved to be 200 miles too far north."*

Hearne's book gives an exceedingly interesting account of life among the Indians at that time, and of the animals and birds found in the vicinity of Churchill, but it contains very little information about the character of the country over which he passed, and nothing about its geology.

West coast of
Hudson Bay.

The west coast of Hudson Bay, north of Fort Churchill, along the eastern edge of the Barren Lands, has been seen by several explorers, but as all have travelled in large boats, or ships, which necessarily kept out long distances from land, or touched it at but very few of the more prominent points, the details of the shore have remained quite uncertain. It is believed that previous to 1893 no white man attempted to travel along this coast in canoes or small boats.

* On some of the Larger Unexplored regions of Canada, by G. M. Dawson. Ottawa Naturalist, vol. IX., No. 2, May, 1890.

About the middle of April, 1612, Captain (afterwards Admiral Sir Thomas Button* sailed from Gravesend in two small ships, the *Resolution* and the *Discovery*, (the latter the same ship from which Henry Hudson had been set adrift by his mutinous crew in Hudson Bay the year before), in search of a north-west passage to China and the Indies, and also probably to try to find some trace of Hudson. After passing through Hudson Strait, Button crossed Hudson Bay and sighted its western shore in north latitude $60^{\circ} 40'$ which he named "Hopes-checked." Here encountering a heavy storm he turned southward, and on the 15th of August ran into Nelson River, so called after the master of the *Resolution*, who died here, where he laid up his ships for the winter. The next summer he left Nelson River, possibly only in the *Discovery*, and sailed northward, rounding Cape Churchill, passing "Hubbart's-Hope" in latitude 60° , and then kept in sight of the shore as far as "Hopes-Checked." He then stood north-eastward past the east end of Marble Island, which he called "Hope's-Advance," and onward into the Welcome as far north as latitude 65° , after which he turned southward and eastward back to England.

Sir Thomas
Button.

The next to reach the north-west coast of Hudson Bay was Captain Jens Munck†, who, in 1619, sailed with two ships from Elsineur through Hudson Straits into Hudson Bay, reaching its west shore in latitude $63^{\circ} 20'$, when he was forced by ice to turn south. He is said to have established winter quarters in Churchill Harbour, where he caught black foxes and sables (martens) which are not found far north of the edge of the woods. During the winter he lost most of his men through scurvy, and next spring, abandoning one of his ships, he returned to Denmark.

Jens Munck.

On May 5th, 1631, Captain Luke Fox‡ set sail from Deptford in the *Charles*, a pinnace of seventy tons burden, to continue the search for the North-west Passage. On July 27th he reached the west shore of Hudson Bay in latitude $64^{\circ} 10'$, going ashore on an island which he called Sir Thomas Roe's Welcome, a name since applied to the strait between Southampton Island and the mainland. His description of the west shore of the Bay, which he examined with some care, is exceedingly quaint and interesting, and shows that the shore had the same character two centuries and a half ago as it has at present.

Luke Fox.

* North-west Fox, London, 1635. Republished by Hakluyt Society, London, 1894, vol. I., pp. 162-179.

† History of the Voyages and Discoveries made in the North, by John Reinold Forster, Dublin, 1786, pp. 470 and 471, and a Chronological History of Voyages into the Arctic Regions, by John Barrow, London, 1818, pp. 230-234.

‡ North-west Fox, London, 1635. Reprint by the Hakluyt Society. London 1894.

Reaches
Marble Is-
land.

From Roe's Welcome he turned south-westward until he raised a white island bearing south-west. He stood around the outside of this island and sent a boat ashore near its south-west point. He named the island "Brooke-Cobham," after Sir John Brooke, afterwards Lord Cobham, one of the patrons of the expedition, not recognizing it as Button's Hope's-Advance, and he says that "it is all of a white marble."

Dunn Fox
Island.

On July 30th, he writes:—"When I had stood about W.S.W. from this island twelve leagues I haled in again W. by N., as I see the ridges and broken land stretch, and, keeping the west main always in sight, many ridges did appear, which to go to the seaward of I stood S.W. and by W. I anchored athwart a little island twelve leagues from Brooke-Cobham. The master, with the boat, went on land when it was low water," and behind this island he saw other islands and ledges at low water, so that he thought he could have gone on foot to the main. As the men here caught a dun fox (probably the blue variety of the white fox) alive, the island was facetiously called Dunn Fox Island. It would appear to be one of the small islands lying off the cape south of Corbett's Inlet. Next day he continued south-westward to latitude $62^{\circ} 5'$, when, standing in between W. and N.W., he anchored among a group of islands, apparently in Mistake Bay, in seven fathoms of water. In his account he says:—"I named those islands *Briggs his Mathematickes*," the rocks and shoals probably putting him in mind of the intricate calculations of his patron, Mr. Henry Briggs. On August 1st, he again stood to sea and when clear, took up a course S.W. by S., but losing sight of land turned W.—"The land met me again, stretching more to south, and many humlocks therein. Stood to within seven miles, and had by six, seven and ten fathoms. I run off a long way before I came into twenty fathoms, passing by two dry ridges that had been far without me." "August 2nd, stood W.S.W. seven leagues to an island (Sentry Island?) and three or four more within it, all lying almost without sight of the main. I stood within them to seven fathoms. I went to seaward off the said island, which is said to have a long reef off its N.E. end." Its position is given as in latitude 61° or $61^{\circ} 10'$. "I turned S.W. and anchored at twenty fathoms." August 3rd, he travelled along the shore, which was "low, but now and then a sandy knowle or downe would appear," S.W. by W. for ten leagues to latitude $60^{\circ} 22'$, where he anchored three miles from shore in seven fathoms and sent a boat ashore, which found remains of a birch canoe, arrows, etc. On the evening of August 4th, he reached Hubbard Point, of which he says: "It is all stones. Upon it were many corpses, and there were carved toys in the graves." They got fourteen days' firewood from this stony

Hubbard
Point.

point, bringing back a boat load to the ship. On the 5th, he writes: "I made way south three leagues to latitude 59° 5', and then I discerned the land to meet upon my weather bough and ahead, so I taked and lay N.W. by N. two leagues. It seemed to be higher land than I had lately seen. I stood thus to northward until daylight, and then I see my land I was upon yesterday morning, and the land within it, which I see yesternight, stretching into Hubbert's Hope. I stood about to the northward, the land looking more pleasant than before, and bolder shore, higher and full of wood, and the daylight being come on I could see the bottom of 'Vainly Hoapt Hubbert.'"

August 6, "Standing along, while this land trented E. and W., we see the entrance of a large river (Churchill River). At the S. entrance of a river was a cliff, like unto Balsen Cliff, near Harwich, and on the south again another great bay, whose bottom was easier to be seen. The S. part of this bay lyeth E. and W., and at the E. end thereof lyeth an island S. and N., about three miles long." Since 1831 this island seems to have been almost entirely swept away.

Pass Churchill River.

Capt. Fox continued to examine the shore south-eastward as far as Cape Henrietta Maria, whence he returned to England.

About 1715, the Hudson's Bay Company built a trading post at the mouth of Churchill River.

Fort Churchill built.

In 1719, this Company sent Messrs. Knight, Barlow and Vaughan, from Gravesend, in two small ships to look for gold, copper, &c., but they all miserably perished on the east end of Marble Island.*

Messrs. Knight and Barlow.

On the 22nd of June, 1722, John Scroggs was sent north from Churchill, in the sloop *Whalebone*, to look for his lost countrymen, and to continue the search for the deposit of copper.† He went as far north as Whalebone Point, in latitude "64° 56'," and about the end of July he returned to Churchill. Among the names given by him are "Pistol Bay," which was applied to one of the inlets north of Whale Cove; "Pits Mount," on Marble Island; and "Whalebone Bluff," at the east end of that island.‡

John Scroggs.

Between 1733 and 1747 Joseph Robson§, a Civil Engineer, spent six years on the west coast of Hudson Bay, either at Churchill or

Joseph Robson.

* Hearne's Journey, Dublin, 1796, pp. xxxviii.

† Hearne's Journey, p. xxxiii, and Dobb's, An account of the countries adjoining to Hudson's Bay, p. 80.

‡ A description of the coast, lakes, and currents, in Button's Bay. London, Anon—n. d. (Probably 1745.)

§ An Account of Six Years' Residence in Hudson's Bay, from 1733 to 1736, and 1744 to 1747, by Joseph Robson, London, 12mo, 1752.

York. During this time he evidently made a survey of the tidal lagoon at the mouth of the Churchill River, showing the character of the shore and the high and low water mark in considerable detail. His published plan covers an area of eighty-two square miles, on a scale of one nautical mile to an inch.

Crow and
Napier.

In the beginning of July, 1737, Messrs. Crow and Napier sailed from Churchill on a voyage of discovery, but they merely went direct to Whale Cove, where they traded with the Eskimos. Whale Cove is said to have been so called, "from a whale's having carried one of the Company's sloops to sea, by its tail getting foul of the anchor and cable." They sent a boat north into Pistol Bay to look for a harbour, but found none. Napier died during the voyage, and Crow returned to Churchill.*

Middleton
and Moore in
the *Furnace*
and *Discovery*.

In the year 1741, Captain Christopher Middleton, in the *Furnace*, a sloop or bomb-ketch, and Mr. William Moore in the *Discovery*, a pink, sailed from England in search of the North-west Passage, which they hoped to find near the north-west angle of Hudson Bay. On the 10th of August, they arrived at Churchill River, where, at the time, the Hudson's Bay Company was building a massive stone fort, and though it was still so early in the season, they decided to remain for the winter, probably using the little harbour at Sloop's Cove as their winter quarters. On June 1st, 1742 (old style), the ice broke up in the river, and at spring tide, on the 9th and 10th of the same month they "got the ship (*Furnace*) out of her dock and moored her." On July 1st, the two ships left Churchill, and sailed northward. Keeping well out from the land, they passed "Brooke-Cobham" (Marble Island) on the 4th, and on the 13th entered Wager Inlet, which Captain Middleton named after Sir Charles Wager. Shortly afterwards they discovered Repulse Bay, whence they turned southward to "Brooke-Cobham."

Marble Island
harbour.

On August 12th, John Rankin, the Lieutenant of the *Furnace*, discovered and explored the harbour on the south side of Marble Island, and in his log of that date the name Marble Island first appears as an alternative for Brooke-Cobham. On the same date he also observed an opening in the land to the westward, but was unable to examine it. This opening is since known as Rankin Inlet. On August 15th, the ships bore away for England.†

Moore and
Smith in the
Dobbs and
California.

As the results obtained on this expedition were not considered at all satisfactory, two ships were again fitted out, the *Dobbs*, of 180 tons, and the *California*, of 140 tons.‡ The former was put in

* A description, etc., of Button's Bay.

† An account of the countries adjoining to Hudson's Bay, by Arthur Dobbs, Esq., London, 1744.

‡ A voyage to Hudson's Bay by Henry Ellis, London, 1748. Another account of the same voyage was written by Mr. Drage, the clerk of the *California*, but I have been unable to see a copy of his book.

charge of Captain William Moore, who had been in charge of the *Discovery* on the previous expedition, and the latter in charge of Captain Francis Smith. On the 20th of May, 1746, they sailed from England, and on the 11th of August made the land on the west side of the Welcome, in latitude 64° . On the 19th they reached Marble Island, and after establishing the port they bore southward to their winter quarters in the mouth of Haye's River, near York factory. In June of the following year they sailed northward, determined, if possible, to find the North-west Passage to the South Sea through the mythical Straits of Anian. The long boat of the *Dobbs* had been enlarged and christened the *Resolution*, and on 1st July, in latitude $61^{\circ} 40'$, Captain Moore, Mr. Ellis and eight hands "went on board, in order to examine the coast," instructing the mate to wait for them in the *Dobbs* at Marble Island. They continued northward to Knight's Island, which is said to be in latitude $62^{\circ} 2'$, and would therefore seem to be one of the islands off the mouth of Ferguson River. From here they had several islands in view, such as Sir Biby's, Merry's, Jones's, etc., "all rocky and barren." From here they sailed into Neville's Bay, at the bottom of which there is said to be a "pretty large river running westward." This is said to be north-west some distance from latitude $62^{\circ} 12'$, but not only this but many of the other latitudes given in the account are very inaccurate. On the 9th of July they directed their course to the eastward and anchored at Sea-horse Island, the most eastward of these islands. "On the 10th we weighed, and stood along shore among many small islands and pieces of floating ice, till we arrived at Whale Cove in the latitude of $62^{\circ} 30'$ north." Its true latitude is about 62° .

Winter in
Haye's River.

Explore the
coast north of
Cape Esqui-
maux.

"We sailed again on the 11th, and arrived the same day at a point in the latitude of $62^{\circ} 47'$ north, from whence we discovered a large opening, running to the westward, to which I gave the name of Corbet's Inlet." On the 13th they rejoined the *Dobbs* and *California*, which were anchored between Marble Island and the main land. In their absence Captain Smith, of the *California*, had attempted to enter Rankin Inlet with his ship, but finding himself among shoals, he desisted, and sent his chief and second mates to examine it, who found it to terminate in a bay.

Corbet's In-
let.

On the morning of the 13th, before their arrival, Captain Smith had sent Mr. Westoll, his second mate, in the long boat to search the coasts between Capes Jalabert and Fullerton. On the 14th the chief mate of the *Dobbs* was sent in the *Resolution* to explore the same piece of coast. The two ships sailed northward along the coast.

Discovery of
Chesterfield
Inlet.

About July 26th, they were again joined by the two boats.—“The officers aboard then reported, that they found an inlet, in the latitude of 64° north, and in the longitude of 32' east from Marble Island, which was three or four leagues wide at the entrance, but upon their sailing eight leagues up it, increased to six or seven leagues wide. That their course so far was N.N.W. by compass, but then it began to turn more to the westward; that sailing ten leagues higher, it grew narrower by degrees, till it became but four leagues wide; that notwithstanding they could perceive the shores open again, they were discouraged from proceeding further, because the water from being salt, transparent, and deep, with steep shores, and strong currents, grew fresher, thicker and shallower at that height.” On Ellis's map, this inlet is called Chesterfield Inlet, but it is said to have been also called Bowden's Inlet, after the mate of the *California*. After obtaining this information about Chesterfield Inlet, the two ships sailed northward and re-explored Wager Inlet, and then returned to England.

The explorations of Fox, Moore and Smith, had shown that there was no hope of a North-west Passage from the west side of Hudson Bay south of Repulse Bay, except possibly by Chesterfield or by Corbett Inlets, the bottoms of which had not been visited.

Captain
Christopher.

Accordingly, in the year 1761, Captain Christopher* was sent from Churchill, in the sloop *Churchill*, to examine Chesterfield Inlet more fully. He ascended it for about a hundred miles, when, finding that the water had become almost fresh, he turned back. In the following year he returned to the inlet in the same sloop, while Mr. Norton accompanied him in a cutter. They ascended the inlet in the sloop to a large fresh-water lake, which they called Baker Lake, at the west end of which they saw the mouth of a river. On Christopher's chart, opposite the mouth of this river, these words are written:—“A small river, full of falls and shoals, not water for a boat.”

Mr. Johnson
explores Rankin
Inlet.

In 1764, Rankin Inlet was explored by Mr. Johnson. His map shows it to be fifty-five miles deep; and thirty-five miles from its mouth he anchored in seventeen fathoms of water. The information given on the face of the manuscript chart received from the Admiralty Office, is all that I have been able to learn about his journey.

Corbett's Inlet still remained unexplored, and the journey made by Samuel Hearne into the interior had shown the existence of a large

* Introduction to Cook's Third Voyage.

Observations on the Passage between the Atlantic and Pacific Oceans, by Wm. Goldson, 4to., Portsea Town, 1793, pp. 45 and 46.

I have also received, through the kindness of Admiral Wharton of the Admiralty Office, London, a copy of the manuscript chart of Bowden (Chesterfield) and Rankin Inlets, made by Captains Christopher and Johnson.

river flowing from Doobaunt Lake, which it was thought might be the river discharging into the head of Chesterfield Inlet.

To decide these two questions, and also to continue the search for the North-west Passage northward from the Welcome, Captain Charles Duncan was sent out to Churchill in 1790, to take command of the sloop *Churchill*. But being unable to obtain a crew willing to sail in her, he returned to England the same year.*

In the following year he was given charge of the brig *Beaver*, a ship of 84 tons, and on the 2nd of May he sailed from the Thames. He examined Corbett's Inlet, which he found to terminate at the mouth of a river navigable only for canoes. He then turned southward and spent the winter at Churchill. Corbett's Inlet explored.

In the following year he entered Chesterfield Inlet. He left the brig in Lake's Harb'our, while he went in the boat to the head of Baker Lake. Thence "he followed the course of the river, by land, until he found it came from the northward, in which direction he traced it near thirty miles, when, being convinced that it must be the drain of some lake in that line, and not an outlet from the Doobaunt, he returned, being satisfied that his following it further could not lead to any useful discovery. Had its course been from the westward, he would not have left it, he says, until he had seen its source."†

In June, 1846, Dr. John Rae started with two boats from York Factory, for Repulse Bay.‡ On the 5th of July he left Churchill, and on the 13th passed the mouth of Chesterfield Inlet, having kept within sight of the shore through part of the distance. On his return in 1847 he passed the mouth of Chesterfield Inlet on August 18th, and on the 31st reached Churchill. He was the first to give us any information about the character of the rocks along this coast, stating that the shore as far north as Cape Esquimaux is low, beyond which it is "lined with bare primitive rocks." Specimens collected by him from Rankin's Inlet are described by Professor Tennant as hornblende-slate, mica-slate, chlorite-slate, talcose-slate, quartz with copper-pyrites, &c.

In 1853, Dr. Rae, while on his expedition in search of Sir John Franklin, entered Chesterfield Inlet, and ascended the Quoiich River, which empties into its north side, in the hope of being able to cross to Back or Great Fish River, but finding it too much obstructed by rapids, he turned back. No account of this journey has been seen by the writer.

* History of Arctic Voyages, by John Barrow, 8 vo., London, 1818, pp. 345-348.

† Observations on the Passage between the Atlantic and Pacific Oceans, by Wm. Goldson. 4to., Portsea Town, 1793, pp. 52-54.

‡ Narrative of an Expedition to the Shores of the Arctic Sea, by John Rae, London, 1850.

Dr. R. Bell. In 1879 Dr. R. Bell, of this Survey, descended the lower portion of Churchill River to the Bay. He described the "Churchill quartzites," recorded the occurrence of some of the glacial striae, and concluded that the sea-level there is now lowering (land is rising) at the rate of seven feet in a century.*

In 1884 Dr. Bell, while on board the *Neptune*, visited Marble Island, and in his report he has described the white quartzite of which the island is composed, and the mica-schists of Deadman's Island, at the mouth of the harbour.†

From what was seen at Churchill and Marble Island, and from the examination of a number of specimens, collected on the coast by a friend, some clearly from loose masses, he gives a note on the geology of the west coast of Hudson Bay. He concludes that the shore from Seal River to Esquimaux Point is underlain by "flat-lying limestones," and that "Huronian rocks prevail all along the north-west coast of Hudson Bay, from Esquimaux Point to Chesterfield Inlet."‡

DESCRIPTION OF ROUTES.

A description of the shore of Lake Athabasca, with the survey made of it in 1893, has already appeared in my Report on the Country between Lake Athabasca and the Churchill River.§

A short distance east of the mouth of Wolverine or Chipman River, on the north shore of Black Lake, there is a portage leading northward to the hunting ground of the Chippewyan Indians. On the evening of the 7th July we camped on the beach at the beginning of the portage. Northward the country was entirely unknown to either ourselves or any of our men, and our only guide was a rude map of the route as far north as Daly Lake, obtained from an Indian during the preceding year.

BLACK LAKE TO HEIGHT OF LAND.

Wolverene
Portage.

The Wolverine portage is two miles and a quarter long, and rises in this distance 210 feet, the height of Black Lake being 1000 feet, and the level of the small lake at the north end of the portage 1210 feet above sea-level. The country through which the portage passes is

*Report of Progress, Geol. Surv. Can., 1878-89, pp. 19-22 c.

†Report of Progress, Geol. Surv. Can., 1882-84, pp. 34-36 D D.

‡Annual Report Geol. Surv. Can., Vol. I. (N.S.) 1885, pp. 18-20 D D.

§Annual Report, Geol. Surv. Can., vol. VIII. (N.S.) part D.

generally thickly wooded with small black spruce, Banksian pine, and larch. There are two or three sandy stretches, but for most of the way the land is composed of light-gray clay, doubtless a glacial wash deposited in the bottom of Hyper-Black Lake, the enlarged post-glacial representative of Black Lake. Through this clay rise morainic ridges of rough, irregular boulders. The following is a paced survey of the portage. Two thousand paces equal one geographical mile:—

N. 25° W. 300	paces.	Over morainic hill seventy feet high, composed of small stones and boulders.
N. 25° W. 300	"	Across a black spruce swamp and over a low ridge of large irregular boulders.
N. 10° W. 45	"	} Over a low ridge of sand and boulders, to an old Indian camping ground.
N. 45° W. 24	"	
N. 20° W. 60	"	
N. 25° W. 150	"	Through swamp to ridge of thinly foliated highly biotitic, dark-gray gneiss, striking N. 60° E. and dipping N. 30° W. < 40°.
N. 20° W. 267	"	Through swamp to a ridge of similar gneiss, wooded with Banksian pines.
N. 25° W. 350	"	} Down a gentle sandy slope wooded with small Banksian pines to a little weedy creek.
N. 10° W. 170	"	
N. 30° W. 50	"	Through swamp.
N. 60° W. 90	"	Up a hill of similar reddish gneiss striking as before.
N. 35° W. 250	"	Through swamp.
N. 50° W. 45	"	} Up a slope of red gneiss to the top of a sandy hill, wooded with small Banksian pines
N. 5° E. 100	"	
N. 35° W. 200	"	Down sandy slope to the edge of a little sandy terrace.
N. 25° W. 35	"	Through swamp.
N. 20° E. 100	"	} Over a low hill of sand and boulders wooded with spruce and larch.
N. 10° W. 200	"	
N. 20° W. 130	"	Through swamp.
N. 10° E. 410	"	Over a dry sandy and mossy plain wooded with small spruce, to a brook.
N. 30° E. 96	"	Open Banksian pine woods.
N. 15° E. 400	"	Up the east side of the valley of a creek, over rising land studded with boulders, and wooded with spruce and birch.
N. 5° W. 240	"	Over similar country to the south end of a small narrow lake lying among rocky wooded hills.
4,012	"	

Camp was pitched at the south end of this little lake, from which a noisy, interrupted brook ran past our tents towards Black Lake, which lay glittering in the sun a few miles to the south. To the west is a rocky ridge 150 feet high, composed of a dark-gray highly hornblendic gneiss, varying to a coarse red augen-gneiss, which strikes N. 60° E., and has an almost vertical dip. Glacial striæ were seen on its summit trending S. 45° W. The south-eastern side of the ridge is steep and thickly covered with boulders, imbedded in a matrix of fine red sand or silt, which supports a thick growth of small black spruce.

Chain of small
lakes and por-
tages.

The little lake is clear and shallow, with a bottom of rude stones. It is from one to two hundred yards wide and nearly half a mile long. A creek flows into its northern end through boulders. The portage track at this end is 1000 yards long, and runs along the bottom of the valley on the east side of the creek. It is hard and dry, being generally over the fine light-gray silt. It ascends about forty-five feet and ends on the shore of another similar lake in a pleasant grove of spruce, where the turf descends to the edge of the water, and the bottom of the lake, close to shore, is of small rounded stones. This second lake is very similar to the last, is a mile long, but has a long arm extending towards the west. It appears to be moderately deep and has mossy banks, while wooded rocky hills descend into it from all sides. Here and there salient points project into the water. A little stream flows into its northern end, descending five feet from another lake. The canoes were carried over the boulders for seventy-five yards, from one lake to the other. The third lake is similar to the last, with high wooded shores, and rounded islands and points of hornblende-gneiss. After following its east shore, the portage leading from it was found about the middle of its western side opposite some small islands.

This portage is 450 yards long, with a rise of fifteen feet, through woods of small black spruce, birch and a few balsam poplars. It is in a valley, over light-gray till thickly studded with sub-angular boulders of reddish granite and gneiss.

The fourth lake is a small shallow pond a third of a mile wide, with wooded shores. The fifth portage is fifty yards long, across a narrow ridge underlain by a reddish-gray medium-grained garnetiferous hornblende-gneiss striking N. 60° E., and with almost vertical dip. The path descends in all fifteen feet to the fifth lake, a pond which is not more than 200 yards across.

The landing at the sixth portage is beside a rocky cliff of reddish gray hornblende-biotite gneiss, with similar dip and strike to the last. The portage is 160 yards long, through spruce woods, across a swamp, and over moss-covered rock down to a lake. The rock is a reddish-gray, well foliated gneiss, striking N. 30° E., and dipping N. 60° W. < 70°.

The sixth lake lies twenty feet below the last, and is nearly half a mile long. The seventh portage is 550 yards long, and like the others it is in a valley, over till holding irregular boulders of granite and gneiss, with hills of gneiss on each side. It has a descent of about fifteen feet to Chipman or Wolvrene Lake. At the end of the portage nearest to Chipman Lake, the rock is a gray, well-foliated

biotite-gneiss, highly quartzose, striking N. 40° E., and dipping N. 50° W. < 65°.

Chipman Lake is a very irregular body of water lying on the course of Chipman River at an approximate elevation of 1210 feet above the sea. The course followed by the Indians in their journeyings to and from the north, passes through this lake for four miles and a half, but we spent more than a day in the lake, and surveyed its shores for twenty-one miles, before we found the river flowing into it.

The shores are unusually high and sparsely wooded. They consist for the most part of dark-gray or reddish hornblende-gneiss, striking N. 45° E., and with a dip approaching more or less closely to vertical. There are a number of islands. Some are high and rocky, others are long ridges of sand and boulders. At the north end of the lake is an even terrace of stratified sand, twenty-five feet above the present water-level, probably formed at the mouth of a stream when the Kewatin glacier retired to the north. The river flows out of the south end of the lake as a swift stream 120 feet wide, and flows into its north-east side in a channel two feet deep between rocks thirty-five yards apart.

The rock on the west side of the river, above Chipman Lake, consists of a fine-grained dark hornblende-granite, intimately folded in with a red felspathic gneiss, without definite strike or dip.

For six miles N. 40° E. from the lake, the river takes the form of a long lake, divided by a low sandy point, past which there is a swift current. In the middle of this lake are many high, rounded, rocky, wooded islands, composed of fine dark garnetiferous granite, interbanded with light-reddish gneiss, striking N. 40° E. and dipping N. 50° W. at an angle of 60°. The shores are also high, the rock rising in rounded bosses gives the skyline a rudely wavy contour. Boulders and rock-fragments are thickly scattered in the low places, and perched boulders were constantly to be seen on the high bare points.

Above this lake the river flows for four miles from N. 25° W. Beside it, in some places, is a low sandy flat scantily wooded with small Banksian pines, while behind, or in places descending to the edge of the water, are dark craggy cliffs of hornblende-gneiss. Three rapids obstruct the upper portion of this reach, and past them portages were made, respectively 80, 1100 and 300 yards long. The middle portage is over very stony hills, having the appearance of a moraine that blocked up the valley. The boulders are for the most part irregular and of local rock, and are imbedded in a gray rock-flour. At the foot of the upper portage is a good exposure of evenly foliated hornblende-gneiss

interstratified with thin layers of light-red felspathic gneiss, striking N. 20° E. and dipping N. 70° W. at an angle of 40°. Behind this portage is a hill, 170 feet high, of dark-gray gneiss, the sides of which are covered with clayey and gravelly till mixed with boulders.

Birch Lake. At this rapid the river flows from Birch Lake, which is thirteen miles long and two miles in greatest width, lying N. 25° E., in the direction of the strike of the underlying and surrounding gneiss. The shores generally descend in wooded slopes, in some places steep, and in others broken by a sandy terrace from fifteen to twenty feet above the water.

Grove of spruce. The river flows into the north end of Birch Lake in a heavy rapid with a descent of fifty feet, over a bed of thinly foliated light-gray hornblende-gneiss. Growing among the stones near the foot of the rapid is a grove of large white spruce. A portage half a mile long runs along the east bank of the river past this rapid, over a ridge of stony morainic hills composed chiefly of subangular masses of gneiss. The north end of the portage opens on the shore of Selwyn Lake, just at the top of the rapid.

Selwyn Lake. Selwyn Lake is fifty miles long in a direction N. 40° E. It lies at an elevation of 1340 feet above the sea, and the temperature of the water in the open lake on July 15th was 58° F. In its south-western portion it averages a mile in width, but in its north-eastern extension it extends an unknown distance towards the east. As we have already seen, it is drained by Chipman River south-westward to Black Lake, but the Indians state that Porcupine River, which empties into Stone River above Black Lake, also takes its rise in this lake.

The shores and islands are usually composed of boulders or bouldery till. The surrounding surface rises and falls in rather gentle undulations, with here and there a higher elongated hill or drumlin. Occasionally low cliffs of brown peat overhang the water. Many of the islands are drumlins, or low elongated ridges of till and boulders, while a few are of waterworn sand and gravel and are evidently kames or eskers.

In the south-western arm of the lake there are comparatively few rock-exposures, those seen being chiefly composed of coarse white massive granite. At a point about the middle of the west side of the lake, the rock is a yellowish-gray highly garnetiferous micaceous gneiss, striking N. 55° E., and dipping N. 35° W. at an angle of 25°. It is cut by a vein of coarse white pegmatitic granite, containing large crystals of white and black mica. Towards the bottom of the north-western bay are sandy terraces, associated with hills of boulders. At the northern end of the lake the shores are generally more rocky than

farther south, and its north-western arm is flanked by hills of gneiss from 200 to 300 feet in height.

The country is more or less generally wooded with small black spruce, but on some of the sandy tracts are orchard-like groves of birch.

HEIGHT-OF-LAND.

The height-of-land is a belt of low stony morainic hills, lying in a rather wide valley between rocky ridges several hundred feet in height. It is a mile and a quarter wide, extending from the shore of Selwyn Lake to a shallow bay at the southern end of Daly Lake. A good dry portage, 2400 yards long, runs through small spruce, from one lake to the other.

DALY LAKE.

Daly Lake lies just north of the height-of-land separating the waters flowing to Lake Athabasca, and thence to the Arctic Ocean, and those flowing to Hudson Bay. It has an elevation of 1290 feet above the sea, or fifty feet less than Selwyn Lake. The temperature of the water in the open lake on July 21st was 58° F. It consists of two portions respectively twenty-three and thirty miles long, lying north-east and south-west, joined by a transverse portion six miles long. At the south end of the lake high hills of gneiss rise on both sides. These soon draw apart or decline, and the banks become low and strewn with boulders. The few hills that remain are composed of till and boulders. Then long low sandy points project from the shore, extending into a chain of sandy islands.

General character.

A large island, ten miles from the south-west end of the lake, is composed of light-green massive and sheared diorite, in which the hornblende is largely altered to chlorite; while some of the points to the south of it are composed of red and green hornblende-gneiss, with a general easterly strike.

Large island.

Eight miles north of the above large island we crossed a neck of land on a portage 500 yards in length, apparently at the base of a long peninsula extending from the western shore. The portage is over a gentle hill of clay and boulders, rising to a height of twenty feet above the lake. To the east is a rugged rocky hill, while to the west the land rises with a light slope.

Peninsula.

A mile north of this portage is a long point, near which is a moderately well foliated light-gray, highly garnetiferous gneiss, striking N. 20° W., and with nearly vertical dip. The surrounding country is characterized by low drumlins, or ridges of till and boulders. The point is of

Esker. boulders, and from it an open sandy ridge, or esker, extends S. 38° W., winding slightly, and gradually rising over some rocky hills seventy feet above this lake. On the side of this ridge some small dwarfed aspens (*Populus tremuloides*) grow, marking the extreme northern limit of the tree in this vicinity.

Northern
limit of pop-
lar.

Rocky shore.

A point four miles to the west, on the north shore, is composed of biotite-gneiss striking N. 30° E., and dipping S. 60° E., at an angle of 45°. Its summit and eastern slope are well rounded, while its western side is much more broken. On the weathered surface are some rough grooves, probably glacial, trending S. 80° W., while in a slight depression is a beautifully polished surface with minute glacial striae trending S. 60° W.

From this point northward the east shore is generally low and strewn with angular fragments of rock. A point in latitude 60° 39' 30", is composed of biotite-gneiss, just behind which is a knoll of a compact medium grained greenstone (diabase?), cut by many anastomosing veins of white granite which cut the greenstone into large eye-like masses or even give it the appearance of a conglomerate. The surface is generally rough and weathered, but some quartz veins have preserved their fine polish, and show many distinct parallel glacial striae trending S. 85° W.

Eight miles further towards the north-east, is the bare rounded point of an island of reddish, white-weathering, massive granite, containing irregular inclusions of gray foliated gneiss. Its surface is smooth and polished, and is marked with glacial striae and small grooves trending S. 70° W. The eastern side of the hill, facing the direction from which the glacier moved, is rounded, while the west, or lee side is rough and broken. In depressions protected from the eastern glacier, five occurrences were found of distinct older glacial striae trending S. 25° W. Two miles and a-half further east, the rock is a reddish biotite-gneiss, containing large phenocrysts of orthoclase, striking N. 15° E., and dipping N. 75° W., at an angle of 60°. For the remaining thirteen miles, to the bottom of the lake, the rock, wherever seen, was a gray biotite gneiss, with a general northerly strike, and its surface was everywhere strongly marked by glacial striae trending S. 70° to 75° W.

Low shores.

The shores are generally low, and are strewn with loose angular masses of rock. These stones did not seem to be anywhere piled in definite boulder-walls. The nearest approach to boulder-walls was at some of the points, where an unassorted mass of clay and boulders had been shoved up to a height of two or three feet. Points or bars of gravel

or sand of any considerable size are also conspicuously absent, and the whole shore is new, and but little modified by either wave or ice action.

Around the shore of Daly Lake, and extending northward to the northern limit of the wooded country, are more or less extensive mossy or tundra areas, usually on gentle slopes that extend from the woods down to the edge of the water. Seen from a distance, these have the appearance of open green meadows. On closer inspection the surface is found to be even, moderately dry and firm, and to be covered with a growth of a light green papery lichen, probably a species of *Peltigera*, cranberry, trailing raspberry, Indian tea (*Ledum palustre*), &c. Beneath the surface is a thickness of eight or ten feet or more of moss, apparently some of the forms of *Sphagnum cymbilium* or *acutifolium*, which is quite dead. In July, at a depth of a foot, the moss was found to be frozen, or rather imbedded in a solid mass of ice. On the upper side of the slope was a scattered grove of spruce and larch, overshadowing a wet mossy swamp, in which the *Sphagnum* was in full growth, while on its lower side the mossy slope usually ended on the shore of the lake in a vertical or overhanging cliff of peat, from which masses of peat were falling on the sandy beach. Several of these cliffs were closely examined, and when the thin outer portion of unfrozen moss was cleared away they were found to consist of a wall of frozen moss, through which were many streaks of clear ice.

Tundras or mossy plains.

These gently-sloping mossy plains would seem to have been formed somewhat in the following manner. The drainage from the higher land accumulated at the bases of the hills on soil which was either impervious in itself or was rendered impervious by being permanently frozen. Moss, small spruce and larch, began to grow on this wet ground, and each winter the moss froze to the bottom, thawing again with the return of summer. It increased in thickness year by year, until it had reached such a depth that the lower part remained permanently frozen, the heat of the summer not being sufficient to thaw it. Many of the swamps in the more northern parts of Canada would seem to be thus permanently frozen, but every summer they thaw to a sufficient depth to permit of the continuous growth of the upper layer of moss and the overshadowing forest of stunted conifers. But in this region the summer heat is not sufficient to thaw the moss to such a depth as to allow trees to grow over the frozen substratum. The trees therefore die, and the moss, having the ice close beneath it and deprived of its overshadowing screen of trees, also dies, and the surface of this dead and dry peat bog soon becomes covered with such small plants as the country will produce.

Mode of formation.

During the summer, the water continues to drain from the higher lands, but is retained along the upper side of the frozen mossy plain. Here the mossy swamp is still growing, and is constantly but slowly adding to the upper side of the slope and thus increasing its area. This growth in area does not, however, go on indefinitely. The frozen mass seems to descend slowly, like a glacier. At the foot of the slope, in most places, is a cliff of peat which is constantly breaking away, and is kept in its place on the lake shore or river bank only by the gradual descent of the moss and ice from the higher ground behind.

In some few places these mossy plains cover level, or almost level, tracts of country. These level bogs have been formed very much in the same way as those on the slopes, by the gradual thickening of the moss and retirement of the line of living mossy swamp to a narrow strip on the edge of the bog. The masses of clear ice that were seen in the faces of the cliffs of frozen moss have been formed in the living swamps as frozen pools, or in the dead bog as little frozen streams over which the moss has gradually closed.

Possibly the explanation here given for the formation of these "tundras" may also apply to many of those in Alaska and Northern Siberia.

TELZOA RIVER.

Esker. Telzoa River flows from Daly Lake in two channels, the more easterly and smaller of which was the one followed. After a course of two miles and a half it opens into a small irregular lake, with low sandy or stony shores, the underlying gneiss showing at but few places. At the bottom of the most north-easterly bay of this little lake is an esker extending N. 77° E. an unknown distance. It is from forty to seventy feet high, and is composed of sand and gravel. In many places it is divided, and a small lake may lie in the hollow between its two portions. Looking from the summit of the esker, the country may be seen to be low and sandy, with many irregular lakes lying in the shallow depressions, and with the intervening land thinly wooded with small black spruce.

Rapid. From the north-western side of the little lake, the river flows as a rapid stream 250 yards wide, with an even bed of boulders, but so shallow that on the 24th of July there was not water enough for the canoes. On the south-west side of the rapid is a level mossy plain extending back to some low hills a mile or more to the south, a cliff of moss and ice eight feet high forming the south-west bank of the river, the channel having here no other confining wall. On the north-east side of

the stream is a wide, mossy flat, or gentle slope, the lower part of which is underlain by an irregular mass of rounded transported boulders. The surface is wet, and the moss is growing, thus differing from the "fossil" swamp on the opposite bank.

Groves of stunted black spruce occur here and there, the trees being ^{stunted spruce and larch,} from six to fifteen feet high, and usually much expanded at the base. Larches are scattered through the spruce, being much the tallest and largest trees in the groves. Their trunks, from eight to ten inches in diameter, are all spirally twisted in the grain.

Under one of the groves is a rounded boss of green and red hornblende-gneiss, striking N. 30° E. and dipping N. 60° W. at an angle of 70°.

Below these rapids is another small lake, with low unwooded grassy shores and occasional sandy beaches, below which again is a long crooked rapid with a descent of about twelve feet, where the stream is crossed by a ridge of light-gray biotite-gneiss, striking S. 85° E. and dipping N. 5° E. at an angle of 70°. At the foot of the rapid is a little stretch of quiet water. For five miles below this quiet water the river is very rapid. The banks are everywhere low and grassy, and the country is flat and sandy or boggy, hills being rarely seen, and the underlying rock being nowhere exposed.

The river next opens into an oval lake three miles long, below which is a long rapid terminating in a swift chute over a rocky barrier, the total descent being about twenty feet. At the foot of the rapid is another small irregular lake, lying among rounded morainic hills of till and boulders. A long point, extending into the western side of this lake, is composed of biotite-gneiss, striking N. 20° W. and dipping N. 70° E. at an angle of 60°. The surface is rounded towards the east, and broken towards the west, but no glacial markings could be detected.

Three miles and a half farther north, on a long low point of similar ^{Hinde Lake.} gneiss in another lake, the surface is well rounded and shows strong glacial grooves trending S. 80° W. For this lake the name Hinde Lake is here proposed, after Dr. George Jennings Hinde.

Near the north-west shore of Hinde Lake, Red Hill rises to a height ^{Red Hill.} of 120 feet, forming the most conspicuous elevation in this part of the country. It is the termination of a long esker, and is composed chiefly of small, somewhat angular pebbles, of red granite, mixed with which are larger rounded pebbles, cobbles and boulders. Several large angular boulders, or blocks of gneiss, are lying half buried in the summit. Its general trend is N. 70° E. It rises more or less gradually from the

east-north-east in a series of parallel elongated overlapping hills, between which are deep depressions without outlet. Low sandy ridges also skirt the sides of the higher ridges.

Lake terraces. Towards the west-south-west, the esker terminates in two terraces, one above the other, of well-rounded gravel, the faces of which are as steep as the gravel will lie. The brow of the upper terrace looks as if the coarse gravel forming it had been dropped there but yesterday, for it is very loose, and does not seem to have been disturbed at all by atmospheric agencies since the terrace was formed.

Red Hill would, therefore, seem to have been formed at the mouth of a glacial river, at the very face of the Keewatin Glacier, when the foot of the glacier was bounded by a shallow lake into which the river discharged its sediment. From the eastern end of Red Hill, the esker, here somewhat lower, extends as a long sand-ridge along the north-west shore of Hinde Lake, reaching the river a short distance below Ptarmigan Rapid, and afterwards extending an unknown distance into the country to the east, marking the line of the old glacial river, wooded with white spruce up to forty feet or more in height, which was the first good timber seen north of Black Lake. One fine even trunk, on Red Hill, measured five feet six inches in circumference two feet above the butt. The surrounding low country is covered with moss or grass, or is wooded with small black spruce.

Ptarmigan
Rapid.

Ptarmigan Rapid is a long swift chute at the outlet of Hinde Lake, down which the canoes were run one at a time, for but one of our steersmen was capable of handling a canoe successfully in such rough rapid water. Beside the rapid the rock is a well-foliated yellowish-gray garnetiferous gneiss, containing, in places, a considerable quantity of magnetite. Here, on the 26th of July, among some small willows, ptarmigan were seen for the first time, hence the above name for the rapid.

Below the gap where the river cuts through the Red Hill esker, the stream enters a region of typical drumlins, or elongated-oval, hog-back hills parallel to the esker, from twenty to fifty feet high, and composed of reddish-gray till and boulders.

Esker.

Ten miles below Ptarmigan Rapid, measured in a straight line, the river cuts through another esker, trending S. 60° W. and N. 60° E. It can be traced by the eye for a considerable distance, rising over the hills and descending into the depressions, being rendered very conspicuous by its covering of tall white spruce.

Moraine.

A short distance south of this esker is a wide ridge of boulders of granite, gneiss, &c., imbedded in a matrix of gray pebbly clay. The



July 26, 1893.

TELZOA RIVER, BELOW PTARMIGAN RAPID.
Esker in the distance.



J. B. TYRRELL. - Photo, Aug. 14, 1893.

SNOW ON THE SHORE OF DOOBAUNT LAKE
At the foot of a cliff of Cambrian Conglomerate.*

ridge, which is eighty feet high, is prolonged into two ridges in a direction S. 20° E. It undoubtedly forms part of the moraine that extends north-westward of the esker for several miles, the general trend of the morainic hills being transverse to the direction of the esker. Just below the esker, the river flows in a heavy rapid between these morainic hills, and the sides of the channel are formed of walls of angular fragments of rock, piled up and shoved back by the ice of the spring.

At the foot of the rapid the river opens into a lake twenty-one miles long and of undetermined width, here called Boyd Lake, in memory of the late Honourable John Boyd, Lieutenant-Governor of New Brunswick.

The moraine extends northward into Boyd Lake, forming a number of low stony islands and shallow stony shores which are very difficult to approach with a canoe. The stones are for the most part angular, and seem to be all of Laurentian granite and gneiss. Another esker crosses the lake through this moraine, forming a chain of sandy islands among the stony ones, and extending in a long sandy ridge on both sides of the lake.

We had now reached the northern edge of the forest, and hence forward any timber seen on this river was in the form of scattered and often widely separated groves. With the disappearance of this stunted forest, mossy plains and bogs also almost entirely disappeared, and they were nowhere found to extend beyond the extreme northern limit of trees.

The shores of the southern portion of Boyd Lake rise in long slopes to heights of from a hundred to a hundred and fifty feet, and the beach is composed largely of more or less angular fragments of rock. Further north the shores rise to low elevations or stony hills, with a matrix of gray pebbly clay. Islands are numerous, and are composed largely of boulders, more or less rounded, usually arranged in ridges parallel to the long axis of the lake. The boulders are of whitish or red granite, or gray or red gneiss, but among them was found one pebble of stratified Palaeozoic limestone.

No rock in place was seen around the lake, or for some distance north or south of it, but doubtless the country is underlain by Laurentian rocks.

Two miles below Boyd Lake, camp was pitched on the Barren Lands for the first time, and we were obliged to search the shores for pieces of drift-wood for fuel. Among the boulders at this camp were a few small ones of white quartzite and fine red and white unaltered sand-

Gneiss.

stone. For seven miles below Boyd Lake, measured in a straight line, the river winds around hills of boulders, with a rapid at every bend, and then, in the bottom of the valley, is the first exposure of rock seen for many miles. It consists of a red, well-foliated hornblende-biotite-gneiss, striking N. 47° E., and dipping N. 43° W. at an angle of 25°. The surface is well smoothed and strongly scored with parallel glacial grooves trending S. 5° E., the direction of motion being clearly indicated by the rounded northern and broken southern surfaces, the latter pointing up the river.

Three miles and a half further down the stream, through a low-lying country, diversified by little hills of sand, boulders and broken rock, is another exposure of the underlying rock, consisting of a gray evenly foliated hornblende-gneiss, striking N. 20° W., and with almost vertical dip. Its surface is smooth, and well marked with glacial grooves trending S. 80° W.

A few small groves of black and white spruce and larch grow beside the river in this vicinity.

For the next five miles the river flows in devious channels, usually with a swift current, at one place breaking into a swift rapid, down which it was necessary to run the canoes one at a time. The banks are gently rounded stony slopes, partly green with grass and moss.

Barlow Lake.

In north latitude 61° 53' the river enters Barlow Lake, so called in memory of Mr. Scott Barlow, formerly chief draughtsman to the Geological Survey of Canada. It seems to be shallow, is sixteen miles long, from two to four miles wide, and, like most of the other lakes on this river, is dotted with islands. On one of the islands, five miles from the south end of the lake, is a low rounded boss of coarse white biotite-granite. Its surface is well smoothed, and shows strong glacial grooves running S. 50° W. Two miles further north, on some other islands, are ridges of boulders extending southward from highest points at their northern ends.

Stony hills.

The country around the southern portion of the lake is a gently undulating prairie, while farther north a marshy border extends along the western shore stretching back to a ridge of stony hills from 100 to 200 feet in height. One of these hills near the north end of the lake, was found to be 130 feet high, and to trend S. 60° W. Its sides and summit are covered with sub-angular boulders, often very large, sometimes imbedded in a reddish-gray clay, but sometimes tumbled together without any matrix. They are chiefly of reddish gneiss, coarse red porphyritic granite and white granite, but some are of green diabase

and red quartz-porphyry. From the top of the hill several other similar ridges, some probably from 200 to 300 feet high, were seen, and between the ridges, stretching away to the north, are extensive low green plains, covered with grass or moss. The hills are probably part of a moraine of the Keewatin glacier which, in its latest stages, here flowed from the east.

At the outlet of Barlow Lake is a heavy rapid, with a descent of about twelve feet, on each side of which are banks of large boulders of red gneiss. On a flat composed of these boulders, on the north-west side of the river, is a small grove of large white spruce trees. At the foot of the heaviest part of the rapid is a boss of coarse red pegmatitic granite, rounded on its eastern, and broken on its western side. Below this rapid a low country was entered, where the river flows with a current of from four to five miles an hour, in a well defined channel a hundred yards wide, with rounded grassy banks ten feet high, of a compact yellowish-gray clayey till with rounded boulders. Boulders are also piled around the points, having been pushed into an even wall by the ice.

Rapid at outlet of lake.

Four miles below Barlow Lake, the river enters the south end of Carey Lake. Carey Lake, so called in honour of the Rev. Dr. Carey, of St. John, N.B.

After paddling up the lake for five miles, directing our course towards a high point with a large boulder on its summit, afterwards called Cairn Point, we saw an immense herd of caribou (*Rangifer Groenlandicus*), moving along the east shore. We at once paddled towards the land, and found the deer standing on low wet grassy land near the water, at the foot of a long stony slope.

Barren-ground caribou.

It was now nearly six weeks since we had left our last base of supplies at Fort Chippewyan, and our provisions were rapidly diminishing, so that the question of how to add to our stock had begun to be a serious one, if we were to continue our journey into the wilderness. Here were deer in abundance, and near at hand was a grove of small black spruce and tamarack, which would furnish fuel to smoke and dry as much meat as we could carry.

The following extract from my daily journal, with the photographs in front of the report, will give a fairly clear idea of the number of deer seen:—

"July 30.—Yesterday was the first clear warm day that we had had for a long time, but to-day is also clear and warm, with a gentle breeze blowing from the west. We spent the day skinning and cutting up the fattest of the bucks that we had killed yesterday. Our camp is a

Extract from
journal.

hundred yards from the lake, near the edge of a bog, with a scattered grove of larch and small black spruce just behind us. All day the caribou have been around us in vast numbers, many thousands being collected together in single herds. One herd collected on the hill behind our camp, and another remained for hours in the wet bog on the point in front of us. The little fawns were running about everywhere, often coming up to within a yard or two of us, uttering their sharp grunts as they stood and looked up at us, or as they turned and ran back to the does. About noon a large herd had collected on the sides and summit of the hill behind us. Taking the small hand-camera with which we were supplied, we walked quietly among them. As we approached to within a few yards of the dense herd, it opened to let us in and then formed a circle around us, so that we were able to stand for a couple of hours and watch the deer as they stood in the light breeze, or rubbed slowly past each other to keep off the black flies. The bucks, with their beautiful branching antlers, kept well to the background. We obtained a number of photographs, which show the animals in many positions. Later in the afternoon a herd of bucks trotted up to us, and stood at about forty yards distance. This was a most beautiful sight, for their horns are now full grown, though still soft at the tips, but unfortunately we had not the camera with us. We did not shoot any to-day.

"July 31.—To-day was again beautifully warm, with a breeze from the south, but we had a squall and heavy shower towards evening. We have been drying meat to-day. The work is very tedious and slow, but it is hardly likely that we shall have such another opportunity, with abundance of meat, wood, and fine warm weather combined. The deer did not come to this part of the shore to-day, but great numbers are over at Cairn Point. Ptarmigan are very plentiful in the vicinity.

"The hills are underlain by a coarse gray biotite-granite, which appears on a few of the higher points, but the slopes are thickly scattered with loose boulders of the same or similar rock, imbedded in a matrix of gray clay.

"A peculiar feature of the gentle slopes here (and throughout the Barren Lands generally) is the great number of little clay terraces, often somewhat circular, and from one to five or six yards in diameter, the clay being often studded with small stones and pebbles, and sometimes there is a cluster of larger stones in the middle. They are quite level, and usually have a little raised ring of grass around their rims. These little clay flats or discs may occur on hillsides, otherwise literally covered with boulders, or they may compose the greater part of

more gentle slopes. In wet weather they are covered with shallow pools of water. The mode of their formation is not very apparent, but it is probably by a sliding of the upper clay over the frozen subsoil.

"A meridian observation of the sun to-day gave us a latitude $62^{\circ} 9' 24''$.

"August 1st.—We are still obliged to remain in camp for the purpose of drying the meat we have on hand. The weather continues warm and dry, though mosquitoes are very troublesome.

"Immediately after dinner we went over to the point two miles north-west of camp. The point is a long sloping ridge 150 feet high, trending N. 75° E. Its sides and summit are scattered with boulders, chiefly of red granite, and on its very crest is a huge boulder of coarse red porphyritic granite nine feet high. On top of this boulder we erected a cairn, under which we put a bottle with a short record of our trip, and a map of our course so far, so that, should any mishap befall the party in the country farther north, our friends may learn of our safe arrival here. Over the cairn we planted a small Union Jack.

"Although the surface of the hill is composed largely of boulders imbedded in a yellow sandy till, I found one outcrop of coarse red granite containing large crystals of pyrite. The surface of the granite showed distinct glacial striae trending S. 85° W.

"No caribou have come near our camp to-day, but we saw a few when over on the point.

"Aug. 2nd.—The morning was gloomy, but the sun came out for a little while, so that we could pack our dried meat in bales, and by nine o'clock we were off."

Temperature of the water in the open lake 54° F.

Two miles north-east of Cairn Point is a shallow strait, with stiff current, connecting wider expansions of the lake. For four miles beyond this strait the north-east shore is marshy or grassy, and then, near the mouth of a small brook, it is broken by morainic boulder ridges a hundred feet in height, the edge of the grassy plain and the foot of the hills meeting in a fairly well-defined line running S. 85° E. The individual boulder-ridges lie in parallel lines extending S. 75° W. A few exposures of rock on the sides of the ridges show that some of them have cores of red granite similar to that of Cairn Hill.

Morainic
ridges.

At the mouth of the brook is a small grassy glade, wooded with white spruce, one tree of which was fifty feet high and thirty inches in diameter, two feet above the butt. Under the trees were ferns, raspberry bushes, etc., the last that we were destined to see that summer.

Large spruce.

Bare rocky
hill.

East of this brook is a hill of bare, red, whitish-weathering granite, the first hill of bare unbroken rock that we had seen for a long time. On its south side are several points on which boulders have been piled by the ice in walls from eight to ten feet high, the bases of the boulder-walls being beneath the water. Opposite to it, on the east shore, is a low point of red hornblende-gneiss, the surface of which is well scored by glacial grooves trending W. On the northern shore, the whole country is one great stretch of angular fragments of coarse red granite broken from the underlying rock, between which there is very seldom any matrix of clay, sand or pebbles.

Glacial striae.

At the foot of Carey Lake is a rounded hill, ninety feet high, of coarse red granite, the summit of which is smoothed, and strongly marked by glacial grooves trending S. 20° E., while any vertical surfaces facing W.S.W. and trending S.S.E. are polished and fluted. The northern side of the hill is rounded, while the southern side is rough and broken. There is also another later set of grooves and striae, showing well on the higher polished points, and trending S. 80° W., parallel to most of the others seen on this part of the river; but they have not affected the general shape of this rocky hill to the same extent as the earlier striae.

Below Carey Lake is a heavy rapid three miles long with a descent of about fifty-five feet, the upper portion of which is divided by a low stony island. On the west bank, opposite the foot of the island, is a low hill of coarse augen-gneiss striking N. 40° E. Below the rapid the river continues to flow in a north-easterly direction for several miles, with stony grassy slopes to the south-east, while to the north-west is a glaciated rocky shore, underlain by a rather fine-grained greenish red-weathering epidotic hornblende-gneiss, striking N. 5° E. but strongly jointed S. 70° E. Its surface is well marked with glacial striae running S. 85° W.

Diorite.

The red-weathered gneiss extends to a point eight miles below Carey Lake, where, at a hill ninety feet high, it is replaced by a massive dark greenish-gray medium-grained diorite, containing large crystals of plagioclase, a small amount of quartz, a large quantity of pyrite and a small amount of sphene. It is cut by several thick veins of white quartz and red rather fine pegmatite. The general surface and summit is covered with glacial grooves and striae trending S. 87° W., but some lee surfaces near the summit show strong glacial grooves running south, and a beautifully polished surface of quartz was covered with fine striae running in the same direction.

The diorite continues along the north-west shore for two miles, while the opposite south-east shore is also high, and the hills seemed to have cores of the same rock, but their sides are sloping and covered with verdure.

At the next rapid, the diorite is replaced by a medium-grained red biotite-gneiss. This gneiss continues to form the shore for two miles, to a point, where it strikes N. 70° E. and dips S. 20° E. at an angle of 40°.

North of this point the river opens into Markham Lake, so called after Admiral A. H. Markham, the well-known Arctic explorer, who has always taken such a lively interest in any explorations in Hudson Bay and the adjoining country.

The southern portion of its west shore, along which we coasted, is low and grassy, being at first sandy and afterwards strewn with boulders. It then becomes rocky, rising to low bare hills of dark-gray highly hornblende gneiss, striking in an east-north-easterly direction, and dipping south-south-east at an angle of 15°, cut by many both wide and narrow anastomosing veins of white pegmatitic granite. The surface is scored by glacial grooves trending S. 85° W.

Continuing northward, the points are low, and are composed of similar hornblende-gneiss, cut by granite veins, but at some distance back the country rises to high bare rounded rocky hills, trenched by deep gorges, in some of which the snow of the previous winter was still lying. The east shore is an even grassy slope, without boulders, descending to a sandy beach.

Near the outlet of the lake, on its west shore, is a rounded hill 115 feet high, the summit of which is composed of rather coarse gneiss, with very irregular strike, while on a point near the water's edge is a finely foliated light greenish-gray biotite-granite-gneiss, the biotite, which is in small amount, being largely altered to chlorite.

The river flowing from Markham Lake is wide, and occasionally rather shallow, with a swift current. After a course of a mile and a half, it empties into the south-east side of Nicholson Lake, so called in honour of Professor H. A. Nicholson, formerly professor of Natural History in Toronto University, and now of the University of Aberdeen. The shores of this lake seemed to be almost everywhere sloping and grassy, though at its south end are several small groves of spruce and larch, and a few dead trunks are standing on the western shore. On a large island near the middle of the lake is a sandy ridge about 200 feet high, with steeply sloping grassy sides, without boulders.

It is possible that this ridge is a kame, associated with one of the terminal moraines of the Keewatin glacier.

North-west of this large island are some smaller ones with steep walls of boulders piled up ten feet high around them. While paddling through these islands we were struck by the appearance of a small white island standing out distinctly among the surrounding reddish ones. This island shows at its south end a low outcrop, extending for 120 yards behind the beach, of fine and even grained well-bedded Cambro-Silurian (Trenton) limestone, striking south and dipping west at an angle of 20'. The lower beds are somewhat more argillaceous, and many fragments of a limestone conglomerate were lying about, but the parent bed of the conglomerate was not seen.

Cambro-Silurian outcrop.

Fossils.

Fossils were scarce and rather difficult to extract, but Mr. L. M. Lambe, of this Survey, has kindly furnished the following notes on the few that were collected.

"*Columnaria alveolata*, Goldf. Three highly silicified specimens, and some fragments, with the structure of the corallites as seen in natural transverse sections well preserved. A comparison of the specimens with the type of this species as figured by Goldfuss in the *Petrefacta Germania*, pl. xxiv., figs. 7a, b, c, leaves no doubt as to the identity of the Nicholson Lake fossil.

"*Streptelasma rusticum*, Bill. A poorly preserved specimen and two fragments, in which the structure is obscured by concretionary silicification. This coral is, on account of its poor state of preservation, referred with some hesitation to Billings's species, considered by its author as typical of the Hudson River group.

"*Calopuccia Canadensis*, Bill. One silicified specimen, of irregular shape, measuring about four and a half inches at its greatest breadth, and about an inch and a quarter in thickness; it is a portion of what was evidently a much larger mass. The numerous pores are shown well in longitudinal sections and the tabule are normal in shape and disposition, as is also the irregular tabulate structure between the corallites.

"*Orthis testudinaria*, Dalman. Two small single valves, a dorsal and a ventral, with rather strong plications; the larger of the two is 7.5 mm. high, and 8.5 mm. broad."

This interesting exposure, only a few acres in extent, is doubtless an outlier of the Arctic Palaeozoic basin. It was the only Palaeozoic limestone seen north of the tributaries of the Saskatchewan River during the summer of 1893, but probably the same or similar beds occur

in the vicinity or further north, for limestone boulders were frequently found scattered among those of granite and gneiss.

From the north end of Nicholson Lake, the river flows northward for two miles and a half down a heavy rapid, with a descent of about forty feet, towards the bottom of which the bank is formed by abrupt cliffs of reddish sandy till filled with boulders, and steep walls of reddish-gray horizontally foliated gneiss. Near the foot of the rapid the stream turns eastward, and for about six miles flows in the bottom of a valley from 150 to 200 feet deep, the banks being composed of horizontal reddish-gray gneiss, while several narrow esker-like ridges of sand and boulders run down the valley parallel to the sides. On the steep hillsides were some small groves of white spruce, the last that we were to see that summer, while the little patches of snow here and there in every direction would have kept us reminded that we had reached a sub-arctic climate, if the almost constant cold rain and wind had not made us thoroughly alive to the fact. On the hillsides Arctic hares were seen for the first time.

The river then becomes more diffuse and irregular, and after flowing for several miles, breaks up into a number of channels, just as it enters an oblong lake. This lake lies north-and-south, and is four and a half miles long. The temperature of its water on August 5th, was 47° F. At its south end the shores are moderately high, but they gradually decline towards the north, until at its north end is an extensive level green plain with no hills in sight. The points on the west shore are composed of reddish-gray gneiss. At one point this gneiss is cut by a dyke, about 140 feet wide, running S. 60° E., of medium-grained dark-gray diorite, much of the augite in which is altered to hornblende, and containing also a considerable quantity of magnetite.

The Telzoa River flows from the east side of the oblong lake, in a well defined channel from 100 to 200 yards wide. Its banks of red till and boulders, are low and sloping, and rise to a wide grassy plain.

On the north bank of the river, half way between the above lake and Doobaunt Lake, is the last grove of black spruce on the river, where the trees are so stunted that they are not as high as one's head. Behind the grove is a low hill of massive red hornblende-granite, the surface of which is moderately well smoothed and rounded, but neither here, nor for some distance back up the river, was I able to detect any glacial striae.

From the top of this hill Doobaunt Lake could be seen lying to the east of us, apparently covered with a solid sheet of ice. Back from the river is a stony plain, parts of which were whitened by the flowers

of the Labrador tea (*Ledum palustre*) or the white tassels of the anemone (*Anemone parviflora*), while many of the knolls were pink with the beautiful little flowers of *Rhododendron Lapponicum*. A mile north of this stunted grove, rising abruptly out of the plain, is a short sandy ridge or esker running S. 70° W.

Fish.

Old signs of
Indians and
Eskimos.

In the river opposite the grove some fine salmon-trout and white-fish were caught, the former weighing as much as ten and a half, and the latter as much as eight and a half pounds. Among the spruce bushes there was some very old chopping, doubtless done by the Chippewyan Indians when they used to descend the Telzoa River as far as Doobaunt Lake. Along the edge of the bank also stones were piled one on another, after the manner of the Eskimos. Probably it was near this grove of spruce that Samuel Hearne, our only white predecessor in this portion of the Barren Lands, had crossed the Doobaunt River in company with a large band of Indians a hundred and twenty-three years before.

For five miles below this last spruce grove, the banks are rather low, and consist chiefly of sloping pavements of boulders, but in two or three places there are cliffs from twenty to thirty feet high, of reddish sand, mixed with rounded pebbles and boulders. The stream is also obstructed by several short rapids over low ridges of gneiss.

DOOBAUNT LAKE.

Extent.

Name.

Survey.

Doobaunt Lake is a large body of clear, cold water of unknown extent, the southern and eastern shores, indicated by dotted lines on the map, having been laid down from rude sketches made by Eskimos. Its western and northern shores were surveyed for 117 miles, but from the summits of the highest hills the opposite shores were nowhere distinctly seen. Its approximate altitude above the sea is 500 feet. By the Chippewyan Indians it is called To-b'o'-t'ua or Water-shore Lake, possibly from the fact that the main portion of the lake is always covered with ice, and that in summer there is a lane of water between this ice and the shore. Its Eskimo name is Tūlēmālūgā. Judging from subsequent Eskimo reports, it has two principal affluents. One of them flows into its southern side, and has scattered groves of white spruce on its banks. The other is the Doobaunt or Telzoa River which we had descended.

Eleven days were spent on the lake, during five of which we were unable to move on account of heavy storms. The description here given is confined to those portions of the western and northern shores explored on the remaining six days, while engaged in the search for its outlet.

The Doobaunt River flows into the west side of the lake in north latitude 62° 55', and near its mouth is a low island of medium-grained red gneiss striking north and dipping west at an angle of 40°. On some gently sloping surfaces the glacial grooves were well shown running S. 87° W.

Island of
gneiss.

The body of the lake was covered with ice and overhung with mist, so that we were unable to paddle out into it, but turning northward in a channel of open water, we found that the shore for a short distance was rather high and craggy, and then it and the many outlying islands were quite low and sloped gently to the water. The points were all composed of gray, or reddish gray, gneiss similar to that seen on the river. Those points facing eastward were constantly well rounded, while the western sides of hills were broken into angular blocks. On one boss glacial grooves were found trending N. 80° W. The surrounding country is a stony plain composed chiefly of angular blocks broken from the underlying rock, among which are scattered a few boulders of white Huronian sandstone, red Cambrian rocks and light-gray unaltered Cambro-Silurian limestone. The surface of the plain is sparsely covered with grass in bunches and with black and green hair-like lichen. (*Alectoria divergens* and *A. ochroleuca*.)

Points of
gneiss.

Teall Point, nine miles north of the river, is an irregular peninsula projecting several miles out into the lake. On this point is a rounded hill a hundred feet high, underlain by a fine-grained red altered felspathic sandstone or arkose. It is chiefly composed of more or less rounded grains of quartz cemented together by interstitial silica. With the quartz grains are many of orthoclase, a few of plagioclase, some flakes of mica altered to chlorite, pyrite in small cubical crystals, the edges of which are altered to limonite, and a few irregular grains of sphene. Running N. 80° E., and extending down the south side of the hill, is a wide ferruginous band cut by many narrow veins of quartz. This sandstone doubtless represents some of the basal beds of the Athabasca series of the Cambrian, which series was afterwards found to have such an extensive development towards the north and east, and Doobaunt Lake would seem to add one more to the number of large Canadian lakes that lie along the contact of the Archaean gneisses and schists, and the overlying Palaeozoic beds.

Athabasca
sandstone.

The ice was found to be packed solid against Teall Point, so that it was necessary to endeavour to find some way of passing behind it. At length a place was found where two bays, one from the south and the other from the north, almost met behind the peninsula, being separated only by a narrow neck of land a hundred and fifty yards wide, over which the canoes were carried.

Ice packed
against the
point.

Dyke of
augite-
minette.

Three miles west of the above-described quartzite hill, in the bottom of a shallow bay, is an outcrop of light-gray granular biotite-gneiss (Laurentian) striking N. 80° E. and dipping S. 10° E. at an angle of 60°. It is cut by a dyke, six feet wide, running along the strike of the gneiss, of a coarse dark-grained gray augite-minette, containing biotite in numerous large idiomorphic crystals, and malacolite, also in large idiomorphic crystals, imbedded in a matrix of coarsely crystalline orthoclase. Some small particles of serpentine are considered by Professor F. D. Adams to be an alteration product of the malacolite. Many fine large crystals of apatite and a small amount of pyrite are also present.

Sericite-
schist.

On a point a short distance further west is an outcrop of thinly foliated light-green sericitic schist, very similar to many of the schists so common in the Huronian, but whether this schist is Laurentian or Huronian was not definitely determined.

North of the neck of the peninsula the shore, with the exception of some distant hills, is low and slopes gently to the water. A small island, lying about three miles north of the neck, consists of a fine-grained thin and evenly foliated light gray-muscovite gneiss, striking S. 80° E. and dipping N. 10° E. at an angle of 60°.

Ridge of
diorite.

Seven miles north of the neck, we landed on the low north-western shore, and found it to be composed of red biotite-gneiss foliated N. 40° E. Behind the beach is a stony and mossy flat extending back to a rounded hill about 200 feet high, probably composed of dark green diorite. Thence north-westward a high ridge runs parallel to the lake, descending with a beautiful even green slope to a sandy beach at the edge of the water. The crest of the ridge alone seemed to be rough with boulders or fragments of rock.

The point south-east of the mouth of Sunset Creek is of a very coarse granite, with large phenocrysts of orthoclase, in contact with a dark-gray mica-diorite, showing rude ophitic structure, composed chiefly of plagioclase and biotite, the latter mostly altered to chlorite, with accessory pale green hornblende, quartz, apatite, epidote, zoisite, and ilmenite surrounded by leucoxene. The summit of the granite hill is well glaciated, the general direction of the grooves and striae being S. 30° W., but some of the higher polished points showed later striae running N. 80° W.

Sunset Creek.

The ice was pushed close around this point, and hearing the sound of a rapid in the bottom of the bay we turned towards it in the hope of finding some willows for fuel. Arriving at Sunset Creek, we found it to be a torrential brook, swollen by the recent rains, flowing from a

wide green valley that extends towards the north-west. It was about thirty feet wide at the swiftest parts. No willows were found, but a smoky fire was made with green dwarf birch (*Betula glandulosa*.)

The next morning the ice had moved a short distance off the point, leaving a clear channel of water around it. The shore east of the point maintains much the same character as before, descending in a long green slope to a sandy beach. After following it for a short distance we left it and struck across to a large island, which was reached near the middle of its southern side. Here the Athabasca series was again encountered, in the form of a coarse and fine red conglomerate, interbedded with layers of hard red quartzitic shale, mottled with green streaks and blotches. The finer beds are constantly covered with ripple marks, and occasionally show sun-cracks. They consist of angular and sub-angular grains of quartz and felspar, with a few scales of biotite, imbedded in a fine-grained matrix stained brown with iron-oxide. The whole series is well bedded, striking S. 10° W. and dipping S. 80° E. at an angle of 25°.

Island of sand stone.

In the next mile and a quarter the conglomerate seems to turn round gradually and strike along the shore, but at the south-east point of the island it strikes S. 20° E. and dips N. 70° E. at an angle of 17°.

The centre of the island rises in a long rounded hill to a height of 100 feet, on the top of which is a clear even grassy prairie. On the shore of this and the adjoining islands the bases of the cliffs were often covered with an accumulation of old snow and ice.

On an island five miles farther towards the north-east, the conglomerate is very coarse, with pebbles a foot or more in diameter, and is cut by a dyke fifteen feet wide of dark-green fine-grained diabase running N. 30° E. Close to the contact the conglomerate is altered almost to the hardness of a granite. The diabase is very much decomposed. In a microscopic section it is seen to be an interlocking mass of crystals, or fine laths, of plagioclase, mixed with larger crystals, frequently much elongated, of augite, altered to chlorite. Besides there are long and large crystals of apatite, a large quantity of ilmenite, often in skeleton crystals, and a little quartz.

Dyke cutting the sandstone.

On the point of an island two miles farther north is an outcrop of a coarse light-gray typical and rather fresh diabase, composed of stout lath-shaped crystals of augite, some of which are altered to hornblende, and some large particles of iron ore.

Diabase.

From this point of diabase we ran six miles north-westward to the bottom of a bay, where camp was pitched on a grassy slope beside a

Hill of gabbro.

hill of **gray massive gabbro**. This hill is well rounded and shows three fairly distinct sets of glacial grooves and striae. The earliest set, well shown in polished protected grooves, runs S. 20° W. Another set runs N. 50° W., while the north-west side of the hill is rounded and strongly scored with grooves and striae running S. 20° E. On a granite island three miles farther east, the only striae distinctly shown were those running S. 20° W.

The surrounding country is a well-grassed undulating **sandy plain**. Two miles south-west of camp is what would seem to be a modified kame or esker. It consists of two rounded knolls or hills of sand and gravel, a mile apart, connected by a low sandy ridge running N. 50° E. The north-eastern knoll is about 200 feet high, and the other 300 feet high, the latter rising as a rounded knoll sixty feet above a level terrace around it, which was probably formed in one of the earlier stages of Hyper-Dooabaunt Lake.

Highly-
altered
conglomerate.

Three miles and a half north-east of camp, across the plain, is a group of hills about 300 feet high, more or less connected by the 240-foot sand terrace. The hill more particularly examined was found to be composed of highly altered red Cambrian conglomerate, with white quartzite pebbles, so hard that it breaks almost indifferently between or through the pebbles. A microscopic section of some of the finer portions showed it to be a loosely coherent rock composed of grains of quartz with a few of felspar, cemented by a large amount of chalcedonic quartz, which is stained red by iron oxide. Some of the quartz grains show secondary enlargement, the secondary silica showing the same orientation as the primary.

Quartz-
porphyry.

The highly altered conglomerate outcrops on the shore of the lake at a point two miles farther east, where it is cut by a vertical dyke running east-and-west, of light-red quartz-porphyry, with microcrystalline groundmass, coloured red by minute particles of iron ore, and showing a distinct flow-structure. It contains phenocrysts of felspar which are largely decomposed, and are often replaced by calcite; and grains of quartz, showing uneven extinction, with very irregular rounded outlines. These quartz grains are broken by many minute cracks, and are usually corroded, the groundmass sending irregular tongues into the quartzes. The groundmass contains fewer ferrites, and consequently is lighter in colour, around the phenocrysts.

Sandy
peninsula.

To the south of the quartz-porphyry is a peninsula underlain by red gneiss and coarse green gabbro, on which are hills of horizontally stratified loose sand, often around a core of sandy till.

From this outcrop the conglomerate, often showing a distinct horizontal bedding, extends eastward along the shore for three miles and then retires from the edge of the lake.

From the foot of the ridge of conglomerate the shore then turns south-eastward, for ten miles, to a long point. For the first two miles the land descends in a long grassy slope, south of which is a prominent point of rounded boulders, probably morainic. In the bottom of a bay east of this point, and on the bank of a small brook, is a rough morainic ridge, forty feet high, of boulders of red and gray gneiss, white quartzite, &c., piled together in the utmost confusion, and without any infilling matrix.

From the brook southward to the point of the peninsula, the westward slope descends from a ridge, possibly of rock, to a low flat grassy shore, with low rocky points; while the eastern slope is composed of boulders or angular blocks of red and gray granite and gneiss, many of which are piled high around the salient points. The rock on the western shore is chiefly a gray medium-grained biotitic augen-gneiss striking N. 35° W. and dipping S. 55° W. at an angle of 70°, holding bands of epidote and schorl. At one point is an outcrop of white, well stratified Huronian quartzite, very like the pebbles of the Athabasca conglomerate. The quartzite is very much crushed, and the grains show uneven extinction. The edges of the grains are all very jagged and irregular, and between them are many smaller grains, apparently broken from the larger ones by the crushing.

The surface of the quartzite is smoothed and scored by glacial grooves trending N. 50° W., while at a point of gneiss, more particularly examined, the surface was found to show three sets of striae. The earliest run S. 23° W. The rounded surfaces on the north side of the knoll are deeply scored by this set alone, while they are also seen in protected grooves on the east side. The second set runs N. 60° W., while the last set runs N. 40° W. up the south-eastern slope, though they are not very strong or distinct.

At the bottom of the bay east of the peninsula are low exposures of red biotite-granite, while three-quarters of a mile inland, up a gentle sandy slope broken by a few granite knolls, is a conspicuous hill eighty feet high, composed, on the south side, of a massive red quartz-porphry or rhyolite, consisting of a micro-crystalline granitoid groundmass, through which is scattered an abundance of ferrite particles, and a considerable quantity of chlorite. In the groundmass are phenocrysts of orthoclase and quartz, besides which are small crystals of apatite, zircon, rutile, &c. On the north side of the hill is a greenish, red-weathering quartz-andesite, very similar to the quartz-porphry,

(Quartz-porphry and quartz-andesite.)

except that the felspar is here a plagioclase. Both these rocks are strongly jointed, and break down into mural cliffs. Through the middle of the hill, between the rhyolite and andesite, is a depression filled with *débris*, possibly marking the line of a basic dyke.

The eastern shore of the bay is a long sandy or grassy slope, rising from the edge of the water to a ridge of prominent hills.

At a point three miles south of the hill of quartz-porphyry is a low boss of gray gneiss, while off the point is a boss of fine-grained green diorite, consisting of crystals of hornblende, sometimes altered to chlorite, surrounded by very much decomposed plagioclase.

Basic granite. On the north side of the channel east of the bay, is a long point of a massive basic granite, consisting of quartz, orthoclase and biotite. The orthoclase occurs in large irregular individuals, surrounded by a fine-grained groundmass of much shattered quartz. Some of the biotite is altered to chlorite, which shows a deep blue polarization colour. Ilmenite surrounded by leucoxene, epidote, apatite and zircon were also seen in the section.

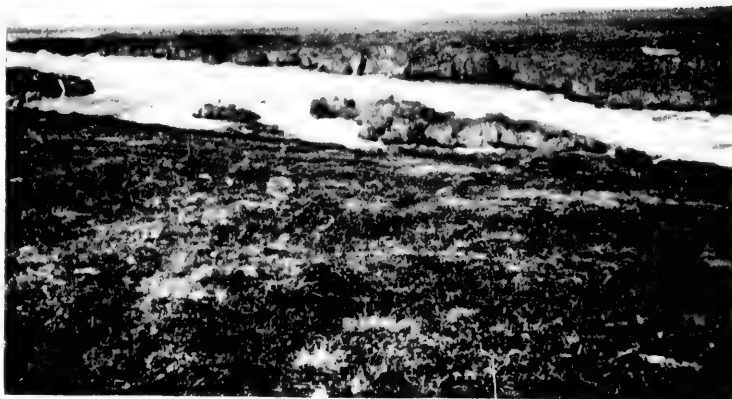
The surface of this granite is well polished and shows glacial grooves running N. 35° W. The south-east side of the point is well rounded, while in the grooves are many curved cross-fractures opening north-westward.

Green diorite and gray gneiss. At a point half a mile further towards the north-east this basic granite is associated with green diorite, and with a rather fine-grained reddish-gray gneiss, composed of quartz, orthoclase, plagioclase and biotite. The latter is largely altered to chlorite, and much iron ore is separated out from it. Spinel is also fairly abundant.

From this point northward for nine miles, to the mouth of a small brook, the west shore is very low, and is composed of boulders and angular fragments of coarse red granite, sloping from low hills down to the shallow water.

Sandy shore. From the mouth of the brook the shore turns south-eastward for five miles. At first it is an even, probably sandy, slope, and then rocky knolls begin to appear, and continue to the point. At the point the rock is a very coarse massive red hornblende-granite, which in places seems to run into a decomposed highly ferruginous quartz-porphyry, cut by veins of white quartz. The surface of the granite is polished and scored by glacial grooves and striae running N. 35° W.

Five miles east of the point, the river was found flowing out of the lake, where the beach is made up of boulders and large angular fragments of fine quartz-porphyry, red amygdaloidal trap, &c.



Aug. 18, 1893.

GORGE, BELOW DOOBAUNT LAKE



J. B. TYRRELL.—Photo, Aug. 25, 1893.

LOUDON RAPIDS, DOOBAUNT RIVER.

Diabase dyke cutting massive red andesites.

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DOOBAUNT RIVER.

The river, where it leaves the lake, is about 200 yards wide. It almost immediately flows down two slight rapids, after which it has a current of four miles an hour, through a wide and almost level plain, underlain by reddish till, which holds small pebbles and boulders. Here and there are occasional knolls of sand and rounded gravel. The channel rapidly deepens, with steep green banks, and the stream rushes on in long swift rapids which required all the dexterity of our good canoe-men to run.

Seven miles below Doobaunt Lake, the river flows over a ridge of coarse reddish hornblende-granite, and then suddenly contracts, and for two miles rushes as a foaming torrent down a narrow gorge about twenty-five yards wide, descending in the distance one hundred feet. The north-west bank is an almost continuous wall of rock, which, however, was not examined; the south-east bank is a steep sandy slope, with rocky points projecting into the gorge at frequent intervals. On this side the rocks seen were:—A fine-grained red quartz-augite-ande-rite or dacite, containing crystals of light green augite, plagioclase, and a few rounded corroded crystals of quartz in a finely crystalline groundmass, composed chiefly of minute crystals of plagioclase, coloured red by numerous inclusions of iron ore. A fine-grained dark-green pitchstone, consisting of glassy groundmass, filled with minute feathers of iron ore, which render the rock very opaque. This pitchstone is cut by veins of quartz with numerous cavities, lined with crystals of amethyst, etc. In contact with the pitchstone is highly altered red Athabasca conglomerate. This conglomerate forms the bank throughout the lower portion of the gorge. The gorge probably marks the line of a dyke of pitchstone or basalt, which has weathered away more rapidly than the surrounding granite and conglomerate.

Past this heavy rapid, which is the most serious obstruction on the whole river, a portage two miles and a half in length was made on the south bank. Where we left the river the bank is thirty feet high, and is composed of reddish till with partially rounded pebbles. After ascending to the top of the bank the western half of the portage is over an almost level surface of till, holding pebbles but no boulders, east of which is a descent of sixty feet to a terrace or plain of gravel, some of which is quite loose and is not covered with grass or herbage. This plain undoubtedly represents one of the higher of the ancient beaches, or shores of Hudson Bay and the Arctic Ocean, when the land stood between 400 and 600 feet lower than at present. Whether the

sea extended over the higher plain was not definitely determined, but the evidence at hand would seem to show that it did. The gravel terrace descends rather steeply to a low country strewn with well rounded boulders.

Grant Lake.

At the foot of the heavy rapid the river discharges into Grant Lake (so named for Sir James Grant, K.C.M.G., M.D.). The lake is seven miles long, and on the 19th August was partly covered by an unbroken field of ice. Its western shore is sloping and grassy, while the beach is often strewn with angular fragments of red granite. Three miles and a half north of Doobaunt River, Chamberlin River, named in honour of Professor T. C. Chamberlin, discharges into the west side of the lake, bringing in about a quarter as much water as Doobaunt River. We subsequently learned from Eskimos that there are trees growing on its banks some distance up from its mouth, but where it flows into Grant Lake no wood, except a few very small willows, could be found. On its banks gravel terraces, marking old sea-shores, rise from seventy to eighty feet above the lake. North of this river is a narrow esker, eighty feet high and between one and two miles long, extending N. 20° W. and running down to a point at its south-eastern end. Its crest, which is chiefly composed of rounded pebbles and boulders, is very narrow, while the sides are as steep as the sand and gravel will lie.

Esker.

Just north of Grant Lake, in north latitude 63° 44' 30", is a hill or esker, 270 feet high, composed of sand and rounded pebbles and cobbles. Around its base are deep kettle-holes, many of them containing ponds of water. The western side, facing the river, is moderately steep, and on it are three fairly distinct terraces or old beaches, the highest one being 120 feet above the lake, probably marking the highest ancient marine shore line. From this hill a long sandy ridge extends into the distance in a direction N. 80° E.

For eight miles below Grant Lake the river is from 200 to 400 yards in width, with a current of from three to six miles an hour. The banks are low, and at first are of stratified gravel, while afterwards they are of rude masses of red gneiss. At the end of the above distance is a heavy rapid full of large boulders, caused by the stream flowing over a band of fine gray micaceous gneiss striking N. 5° W. At the foot of this rapid the river expands into a small lake, which was choked with heavy ice. Its north shore is rocky, though not high, while the south shore is sloping and sandy.

Here we turned eastward, and just as we entered the river below the lake a solitary deer-skin tent was seen on the bank. On coming

to this tent we found that it was occupied by an Eskimo, with his two wives and five children. From him we obtained some slight information about the river ahead of us, but we were also lead to believe that there were many more Eskimos camped on its banks from whom we would be able to obtain information from time to time. This proved to be misleading, as for the next thirteen days we did not see another Eskimo, although it was evident then they had been camped beside the river in many places.

Below the point on which the Eskimo was camped are a couple of small lakes, with sloping sandy shores. Below these, for three miles and a half, the river is very swift, and at one point there is a fall ten feet in height over a ledge of massive red and green epidotic quartz-diorite which contains large crystals of plagioclase, with smaller intermediate grains of quartz and plagioclase, biotite altered to chlorite, hornblende, epidote, apatite, and iron ore altered to leucoxene. Quartz-diorite. Just this fall is a portage on the south side 250 yards in length.

Wharton Lake, so called in honour of Admiral W. J. L. Wharton, Wharton Lake. R.N., F.R.S., Hydrographer to the Admiralty, was entered a mile and a quarter below the above rapid. It is rather oval in shape, and lies in a north-and-south direction, having a greatest length of twenty-one miles, and a greatest width of about seven miles. The greater part of two days was spent in this lake, struggling against head winds, surveying its western and northern shores, and looking for its outlet, which was found about the middle of its eastern shore. The western shore is a grassy slope, rising to a terrace thirty feet above the water, or to rounded grassy hills sixty feet high. From the foot of the slope long points of boulders and masses of red quartz-porphry and mottled red sandstone run out into the water, and the shore and hills are also largely composed of loose masses of red quartz-porphry. The whole character of the country suggests a morainic area.

At the north-west angle of the lake, behind a long island, Laurentian gneiss appears, its surface being marked by glacial grooves trending N. 60° W. The remainder of the northern, and the northern half of the eastern shore of the lake, consists of hills and ridges of boulders, imbedded in a sandy till, and overgrown with grass. On the point just north of the outlet of the lake is a rounded hill 230 feet high, of white Huronian quartzite, seamed by narrow veins of white chalcedonic quartz. Hill of Huronian quartzite. It lies on a low anticline striking N. 35° E., the rock on the summit being horizontal. The top of the hill is beautifully polished, and is marked by two sets of glacial grooves and striae, the later set trending N. 75° W., while the earlier set, seen on

Quartzite hill. lee surfaces, trends S. 28° W. On the southern side of the hill are three well marked gravel terraces, respectively 60, 105 and 130 feet above the lake. The lower two are of fine gravel and coarse red sand, and their brows are quite bare of vegetation, so that they form two conspicuous red lines on the side of the hill. The upper one is on a steeper part of the hill, and its face is almost vertical. It is composed of well-rounded coarse gravel and small cobbles, now all blackened with lichens. Around a little stone fire-place on the top of the hill were the remains of musk oxen which the Eskimos had recently killed.

Below Wharton Lake the river flows at first eastward, and then southward, for four miles to a small lake, in which distance it rushes down two rapids with descents respectively of 15 and 6 feet.

Small shallow lake.

The small lake seems to be everywhere shallow, though the water is very clear. On its south side is a sand ridge (or esker?) about 300 feet high, trending east-and-west, on the side of which the three terraces seen at the quartzite hill are well shown. Towards the west end of the ridge are scarped banks of sand about eighty feet high. On the north side of the lake is a cluster of low islands, composed of boulders of red gneiss, covered with moss and grass. Low hills of boulders continue eastward, along the course of the river, for the next five miles. The stream has no well-defined channel, but flows around and between these hills with a current of from five to eight miles an hour. Five miles below the small lake is a rapid with a descent of twenty feet, past the lower part of which a portage 400 yards long was made over a hill of boulders, and we embarked from a sheet of ice that, on the 23rd of August, was still frozen to the bank. Above the rapid a gravel plain extends a long distance back from the river. At the foot of this rapid the river turns at right angles and flows northward for seven miles as a wide shallow rapid stream, through low country, composed of small morainic or drumlin-like hills of boulders of light-gray well foliated gneiss.

Rapid and portage.

Lady Marjorie Lake.

Lady Marjorie Lake, so named as a mark of respect to the daughter of Their Excellencies the Governor-General of Canada and Lady Aberdeen, was entered at the south end, in approximate latitude 64° 7'. Thence it extends northward for twelve miles, gradually expanding in width towards its northern end. The east shore is at first low, and then rises in a long high grassy ridge, probably an esker. The west shore, along which we coasted against a strong head wind, consists generally of low stony hills, forming a typical till-covered landscape. One low rounded boss of well-foliated biotite-gneiss, striking S. 77° E., was seen near the south end of this shore, its surface being marked by glacial grooves trending N. 67° W.

At the north-west angle of Lady Marjorie Lake the river leaves it, near the base of a high sandy hill. Thence the stream flows north-westward for two miles to the east side of a similar hill of sand and gravel, at the foot of which is a swift rapid over a ridge of rather coarse red epidotic and hornblende granite, often containing inclusions of light-gray micaceous gneiss. The total fall in this rapid is about twenty feet. In descending it one of the canoes was badly broken on a stone.

Canot Cassé Rapid.

Below Canot Cassé Rapid the river continues in the same north-westerly direction, but the current moderates, and the banks are well-defined and sandy. Seven miles below, in latitude $64^{\circ} 18'$, is a group of hills from 200 to 400 feet in height, which had been conspicuous objects in the north for several days. One hill, 200 feet in height, was ascended. It is composed of mottled, light-greenish, coarse diabase, made up of large interlocking lath-shaped crystals of plagioclase, between which is augite, largely altered to a light-green hornblende. With these are crystals of apatite, and a number of particles of copper-pyrites. The hill is part of a dyke about 120 feet wide, running N. 35° W.; its sides are broken, and in many places abrupt and mural, or composed of tumbled angular fragments, giving it a very inaccessible appearance from a distance. Its summit is strongly marked by two distinct sets of glacial striae, the later one running west, and the earlier one S. 20° W.

Conspicuous hills of trap.

The surrounding hills also seemed to be composed of the same green Five terraces diabase. On one of those rising to the east, five distinct terraces, representing old beaches, are clearly marked. The uppermost one, doubtless the same shore-line as the upper terrace on the quartzite hill by Wharton Lake, is about 200 feet, and the lowest one is about 100 feet, above the river. The other three are between these. At the south point of the hill they appear as five well cut notches, from which gravel ridges extend along its sides.

From this point a ridge of hills, composed of similar diabase, continues north-westward, while the river flows with an easy current at the foot of the ridge. South-west of the river, a level plain extends into the distance.

Fifteen miles below Lady Marjorie Lake, the river suddenly narrows to a swift rapid, between walls of coarse red andesite, below which, for several miles, it flows in a well defined channel 200 yards wide, with steep banks of red bouldery till, gradually increasing from 50 to 100 feet in height.

Banks of andesite.

Loudon
Rapids.

Twenty-six miles below Lady Marjorie Lake, in latitude $64^{\circ} 27' 12''$, a narrow dyke of green diabase crosses the river, forming a heavy rapid, here called Loudon Rapid, after the President of Toronto University. The diabase dyke cuts through a coarse red massive andesite, composed of a fine-grained micro-felsitic groundmass, coloured by a number of rods and granules of iron ore, in which are imbedded large phenocrysts of plagioclase, very much decomposed. There are also a few crystals of light green chlorite, with dark borders of magn. tite, and a few scattered crystals of apatite. The rock is very much jointed, and breaks easily when struck. Along the jointage-planes it is often considerably decomposed, with the formation of a green crust of copper-carbonate.

Banks of red
till.

For five miles below Loudon Rapid, the river continues to flow in same north-westerly direction, with a current of four miles an hour. The banks, from 50 to 100 feet in height, are often scarped, and are composed of light gray or red till, containing boulders, overlain by stratified deposits of similar composition. The river has all the appearance of a prairie stream, rolling prairie stretching out on both sides, and steep banks of till descending to the water.

Athabasca
conglomerate.

At a point on the north-west shore of a small shallow lake, seven miles below Loudon Rapid, is a scarped bank showing thirty feet of light-gray sand, with boulders, at the foot of which is an outcrop, six feet in thickness, of light-gray rather fine Athabasca conglomerate, horizontally bedded, but much jointed, the pebbles in which are almost entirely of quartzite.

For three miles below this shallow lake, or a total distance of thirty-six miles from Lady Marjorie Lake, the river continues in the same north-westerly direction, on a direct course toward the Thlew-e-choh, Great fish or Back's River, and it seemed to us almost certain that we were travelling down a tributary of that stream, and not on any river flowing into Hudson Bay. We were now many miles north of the head of Chesterfield Inlet, and every mile travelled was taking us almost that much further away from the inlet, and that much nearer to Back's River. That there was no large stream flowing into Hudson Bay north of Chesterfield Inlet, had been rendered reasonably certain by the exploration of Dr. Rae up Quioich River, and by the winter journeys of Lieutenant Schwatka from Daly Inlet to the mouth of Back's River. The spirits of the party sank as they thought of the long and toilsome return up this river, to be begun just a couple of weeks before the arctic winter should set in. But three miles below the small lake, the river broke up among sandy hills and islands, and through these a large stream seemed to join the Doorbaunt River from the west. Clumps of willows were growing on the banks, and a

considerable quantity of driftwood was scattered about, consisting of Mouth of Thelew River.
dead trunks of white spruce, a foot in diameter, limbs of balsam-poplar, etc. These had evidently been carried down by the tributary from the west, the banks of which must be fairly well wooded, and there can be no large lakes on its lower course to arrest the driftwood. Information subsequently obtained from Eskimos tended to confirm these conclusions. The river is almost certainly the Thelew River, of which Captain Back had been informed while journeying to the source of Back's River in 1833. One branch of this stream probably rises not far from Lake Athabasca and flows northward parallel to the Telzoa River, being reached by ascending either Charlot or Grease River.

From the first driftwood at the sand-hills the river turned towards the north-east. After continuing down the stream for five miles camp was pitched on a small island in latitude $64^{\circ} 36' 26''$, behind a sandy beach, with a thick grove of willows three feet high behind the tents. The surrounding beaches were all sandy, quite different from the stony and gravelly shores higher up the river. Here we enjoyed the first good fire we had had for three weeks.

From this camp in the delta of the western river we descended a fine wide stream, with its low grassy and sandy banks, until, after a few miles, it turned directly eastward. A short distance below this bend is a small island, on which is a hill a hundred feet high of horizontally stratified white sand, on the summit of which are well-rounded pebbles. Hills of sand of similar character extend back from both sides of the river. They all probably represent a bar formed across the mouth of the bay to the west when the sea stood at the level of their summits. River turns eastward.

Six miles and a half east of this sandy island is a low cliff of white till, the boulders in which are chiefly of white and light-red sandstone. A short distance farther east, the river flows into the west end of Aberdeen Lake.

Aberdeen Lake—so called as a tribute of respect and esteem to His Excellency the Governor-General of Canada—is forty-four miles in length and about sixteen miles in greatest width, with an area of from two hundred to three hundred square miles. The temperature of the water on August 28th was 40° F. The south shore is a moderately high but gently sloping grassy ridge, while the western portion of the north shore consists chiefly of rather high drumlin-like ridges of sand and boulders, between which are often long gentle slopes descending to the water. The beach is usually sandy, but the more prominent points are closely packed walls of boulders, while pavements of rounded cobbles and boulders often extend out into the lake from the edge of the beach. Aberdeen Lake.

Terraced hill
of sandstone.

Four miles west of the outlet of the lake, a gentle grassy slope rises a hundred feet to the foot of a ridge of coarse sandstone which is about 400 feet high. From the top of this slope the rocky hill is steep and rugged, with vertical cliffs of hard white or light-red sandstone which is thickly and horizontally bedded, and often contains so many pebbles of white quartzite as to change it into a conglomerate. The summit of the hill is well glaciated, the glacial grooves trending N. 35° W. Several gravel ridges, or old beach-lines, are well marked on its sides, with the following elevations in feet above the lake, viz.: —60, 90, 105, 150 and 180, the last being marked by a strongly cut terrace. Above these are one or two other benches, the heights of which were not determined.

Still higher
terraces.

Six miles further east, on the east side of the outlet of the river, is another hill 400 feet high, of coarse horizontal sandstone and conglomerate. On this hill the upper beaches can be clearly traced. The foot of the upper cliff, possibly an old beach-terrace, is 320 feet above the lake, but a very distinct old beach of rounded gravel and cobbles is clearly marked at a height of 290 feet. There is another beach at 220 feet, and a stony terrace at 170 feet, corresponding to the 180 feet beach on the other hill. On the side of this hill is a little valley down which a small glacier seems to have flowed, leaving little lateral and terminal moraines of boulders.

Outlet of
Aberdeen
Lake dis-
covered.

The river flowing from Aberdeen Lake was discovered from the summit of this hill, previous to which most of a day had been spent in the south-eastern bay searching for it. As seen from here the country to the north, beyond the river, is low, grassy, and dotted with lakes, while to the east is a ridge of rough, stony hills.

From Aberdeen Lake we groped our way down the river for a couple of hours in a thick fog, and as the fog cleared away we were approaching a shallow rapid where the water spreads out over a bed of gravel, below which the river flows for several miles with a width of from a quarter to half a mile, with low gravel banks, to a small lake.

Hills of
gneiss.

A stop was made on the north side of this small lake in latitude 64° 43' 27". A mile to the north rises a ridge of bare, smoothly rounded hills 300 to 400 feet high, composed of horizontally foliated gray micaceous gneiss, cut by many veins of red pegmatite. The summit is strongly scored by glacial grooves trending N. 30° W., the direction of glaciation being clearly indicated by the smoothed and rounded south-eastern slopes, and the jagged and broken hillsides facing north-westward. South of that portion of the hill just described is a depression filled with



Aug. 27, 1893.

HILL OF SANDSTONE, NORTH OF ABERDEEN LAKE.
Showing ancient marine terraces.



J. B. TYRRELL. - Photo, Sept. 2nd, 1893.

ESKIMOS. NEAR THE MOUTH OF DOOBAUNT RIVER.

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débris, and across this is a lower hill of a red ferruginous rock intersected by quartz veins. Under the microscope this ferruginous rock is seen to consist of sharply angular grains of quartz imbedded in a crypto-crystalline matrix, which is deeply coloured by fine particles of ferruginous material, and shows very distinct flow structure. The quartz grains show uneven extinction, and many of them are composed of more than one individual. Occasionally their sides are broken and penetrated by tongues of the matrix. A short distance further east, on the line of the middle of the gap, is a red porcellaneous breccia, very similar to the last, but containing grains of felspar as well as quartz. Quartz-porphry.

Between the hills and the shore is a fairly level grassy plain, strewn with boulders and angular fragments of unaltered sandstone, but none of the rocks from the hills to the north could be detected.

The small lake lies in the valley between the rounded hills of Laurentian gneiss to the north, and the hills of Cambrian sandstone to the south. Its shores are generally sloping and grassy, and there is a pebbly beach, but boulders are rare. The outlet of the lake is in the middle of a low level grassy plain. A high wall of boulders is piled on each side of the channel, which is between 300 and 400 yards wide.

At a point on the north bank of the river, a short distance below the lake, is a low outcrop of almost horizontal thin-bedded red sandstone.

Schultz Lake, so called in honour of the late Sir John Schultz, who did so much to promote exploration in northern Canada, receives the Doobaunt River at its western end. It lies in an east-and-west direction, is twenty-four miles long, and perhaps seven miles wide, but its northern shore was not closely explored. Schultz Lake.

At its western end, the northern shore seemed to be a continuation eastward of the ridge of Laurentian gneiss, while the south shore is low, with rounded hills in the distance, doubtless of sandstone. A point on this shore four miles east of the mouth of the river, is piled high with boulders, chiefly of white sandstone and conglomerate, but some are of green trap, green schist, and thinly foliated gneiss. Further east the south shore rises from the beach in a long grassy slope to the summit of a ridge of thickly and horizontally bedded sandstone or conglomerate. The beach is usually a pleasant strand of waterworn gravel, but in some places the gravel and boulders have been shoved by the ice into a high smooth wall. Character of shores.

At the south-east corner of the lake is a narrow channel into a deep bay, at the bottom of which is a ridge of high hills. On each side of the channel are similar high hills, the lower parts of which are sloping

High hills of sandstone.

and grassy. The hill to the south is composed of horizontal thick-bedded sandstone or conglomerate, while the hill to the north is very similar in appearance, and is probably composed of similar rocks, but dipping north-westward at an angle of 25°.

Four miles farther north is a rounded hill 400 feet high of white and red thick-bedded quartzitic sandstone, striking N. 25° W., and dipping S. 65° W., at an angle of 25°. Some of the beds of sandstone show distinct ripple-markings. Bands of conglomerate, with white quartzite pebbles, are interbedded with the sandstone. Specimens of the conglomerate from this place subsequently assayed for gold and silver proved to contain neither. On the sides of the hill and along the beach were a number of pebbles of green chloritic schist, indicating the presence of these rocks in the vicinity.

Glacial striae.

The surface of the summit is strongly glaciated, the striae trending N. 50° W. There is a well marked terrace, or old beach, on the side of the hill, at a height of 260 feet above the lake.

Four miles north of this hill, the river leaves the north side of Schultz Lake in a channel a quarter of a mile wide, with low banks of horizontal white sandstone on both sides, behind which are rather high bare rounded hills of sandstone.

Rapid near outlet of Schultz Lake.

The river flows northward for a mile and a half, descending a swift but deep rapid with a fall of five feet, to the foot of a ridge of heavily jointed, red, medium-grained biotite-granite, which descends with a steep slope to the water. Here, at the extreme northern point of our journey, the river turns sharply, and flows south-eastward along the foot of the granite ridge, between the granite to the north, and a rounded grassy ridge of sandstone to the south. After flowing in this direction for four miles, it turns sharply north-eastward, and, at a rough heavy rapid, cuts through a ridge of the gray granite-gneiss, the strike of which is here north-eastward, while its dip is nearly vertical.

Huronian Schists.

Below this rapid the river enters a gradually deepening valley, and flows at the rate of six or seven miles an hour, between banks of light-gray, stony till. A heavy storm, with rain, now set in, and though the steep banks were soon seen to be composed of green Huronian schists, it was impossible to examine them, and we rushed on until we came to a stony flat in the valley, where we pitched our camp, and the men were able to collect some small, but green, dwarf birch for firewood.

The storm continued to rage for three days, during which time we were unable to launch our canoes.

The low hills behind camp were composed of thinly foliated light-green chloritic schist, striking S. 50° W. and dipping S. 40° E. at an

angle of 55° . The schist, probably a crushed diabase, is composed of grains of plagioclase, orthoclase and quartz, in a fine holocrystalline matrix of similar material. With the above minerals are crystals of hornblende, some of augite, and a little titanite iron ore and leucoxene. In places the schist contains a large quantity of pyrite, and is cut by veins of white quartz, mixed with calcite. A short distance below camp was a hill of this green schist, cut by two dykes, respectively twenty-five and ten feet wide, of dark-green fine-grained basalt, almost vertical and running nearly with the strike of the schist, although occasionally spreading out a little, and breaking across its foliation. The rock is much coarser in the middle of the dykes than at the sides, and shows a strong transverse jointing. Under the microscope it is seen to be an interlocking mass of minute rod-like crystals, probably of feldspar, imbedded in a fine-grained groundmass, blackened with minute rods and particles of iron ore. Here and there is a rather large crystal of augite. Close to the line of contact with this dyke, the schist is hardened, and there is often a narrow vein of white quartz, highly charged with pyrite.

Dykes of
basalt.

The surface of the rock is well glaciated, the striae trending N. 50° W., up the valley.

From camp, the river flows south-southeastward, across the strike of the schist, perhaps along the line of an eroded dyke, in a valley about 300 yards wide, and from 50 to 150 feet deep. The brows of the hills on both sides are bare and evenly rounded, and the banks slope steeply to the bottom of the valley. During, or at the close of, the glacial period, the valley has been filled with gray stony clay to a height of about thirty feet above the present level of the water, and the existing river is usually from thirty to fifty yards narrower than the rocky valley, so that on one side there is often a sloping bank of clay, while on the other side is a cliff of rock. Many broken shells of *Saxicava rugosa* were found on the top of this terrace of stony clay. At a hill on the west bank, 130 feet high, the green chloritic schist was found to have the same strike as at camp, but to dip N. 40° W. at an angle of 60° . The summit of this hill is scored by glacial grooves trending N. 70° W.

Old valley.

The river continued to flow with a swift current between sloping stony banks in a narrow deep valley, with high hills on each side, those to the east being much the more abrupt and precipitous, while those to the west descend in grassy slopes.

Ten miles above Baker Lake, we found a small band of Eskimos encamped in three tents on the west bank. We were received by

them in a very kindly manner, and some of the men volunteered to accompany us down the river in their kyacks, or small canoes of deer-skins.

Chloritic
gneiss.

Two miles below this camp is a hill, a hundred feet high, of green chloritic gneiss, striking S. 50° W., in the same direction as the schist. It is cut by some wide veins of red granite, and by several narrow dykes of red mica-trap, the latter composed of a groundmass of small interlocking crystals of very much decomposed felspar, coloured with particles of iron ore, in which are imbedded many phenocrysts of biotite, now largely altered to chlorite. Secondary particles of calcite are also scattered through the felspathic matrix.

The summit of the hill is strongly marked by glacial grooves trending N. 50° W.

About two miles above its mouth the river becomes wide and shallow, with a bed of rounded boulders, and with high ridges of boulders along each side. On the top of one of these ridges was a camp of ten or twelve tents of Eskimos, who received us kindly, but like the others, they were very much surprised to see white men descending the river.

Baker Lake
reached.

On the evening of September 2nd, we reached the mouth of the river at the north-western angle of Baker Lake, and pitched our camp on a low flat, close to an exposure of coarse red horizontal sandstone. We had successfully crossed through the middle of the Barren Lands, and had now reached a point where Captains Christopher and Duncan had been before us in their search for the North-west Passage, though for more than a hundred years no white man had visited the spot or had entered Baker Lake. Seven hundred miles of travel had still to be accomplished before even the most remote trading post inhabited by white men could be reached.

General
character

Baker Lake lies in a general east-and-west direction, with a total length of about forty-five miles, and a width which, though as yet undetermined, seems to be considerable. It is for the most of its extent free of islands. On September 6th the water in the open lake had a temperature of 41° F. Its southern shore was not examined, but at its western end it appears to be of sandstone. The north shore was surveyed with a compass and boat-log, and the following description applies to those portions of it on which we were obliged to land.

From the mouth of Doobaunt River we paddled out into the lake, being barely able to ride the heavy waves, and coasted eastward. Just east of the mouth of the river is a high hill, probably of sandstone,

descending with long grassy slopes to the lake. Two miles from the river the shore drops back into a bay, and thence for nine miles it is bounded by a ridge of gneiss from 200 to 300 feet high. At Prince Point is a low exposure of red sandstone dipping southward at an angle of about 30° , and the beach is composed almost entirely of flattened pebbles of similar sandstone.

Prince River, so called after Professor E. E. Prince, Commissioner of Fisheries for Canada, is sixty feet wide at its mouth, and flows from a wide, gently sloping valley coming from N. 55° W. Three-quarters of a mile from the lake is a rapid with a descent of three feet, above which the stream appeared to be rapid and shallow, with an average width of about sixty yards. West of the mouth of this river is a hill of thinly foliated medium-grained gneiss, with red and gray bands, striking N. 65° W., and with vertical dip. On its south side, running almost with the strike of the gneiss, is a wide dyke of massive red augite-andesite, composed of a reddish fine-grained crypto-crystalline groundmass, through which are scattered a large number of particles of iron ore. It contains many large phenocrysts of biotite, which are almost entirely altered to chlorite and calcite, and many small crystals of light-green chlorite (?) surrounded by a black ferruginous border, probably altered from augite. Augite-andesite.

At the rapid three-quarters of a mile up the river, the rock is a dark hornblende-schist, probably a crushed diorite or gabbro. It is cut by veins of granite, and includes irregular masses of fine-grained light-gray gneiss.

At this place the surface of the rock is beautifully smoothed and polished, and is generally scored by glacial striae running S. 30° E., made by a glacier that descended the valley of the river. On some polished surfaces on the south side of the hill, other and older striae were seen trending N. 75° W. On the hill at the mouth of the river the striae of the local glacier were not seen, but the whole surface is strongly marked by glacial grooves trending N. 55° W., the direction of motion of the glacier being clearly shown by the rounded south-eastern slopes and the broken hillsides facing the north-west. Cross-striae.

East of the mouth of Prince River is a terraced rocky hill about 400 feet high, the terraces, representing old sea-beaches, extending up almost to its summit. The central knoll, rising above the terraces, appeared from the distance to have a slightly columnar structure, but whether it is of andesite, red conglomerate, or of some other rock, was not determined.

Ponds frozen. A heavy storm set in as we reached the mouth of Prince River and detained us on the shore for two days. On the morning of September 5th, before we left camp, all the small ponds were frozen over, and the wet sand of the beach was frozen sufficiently hard to permit a man to walk on it readily.

Absence of caribou. For the past month the party had lived almost entirely on reindeer meat, for reindeer had been plentiful all along the banks of the river; but at Prince River we left the reindeer behind, and from there onward to Churchill none were shot. A fuller knowledge of the habits and distribution of these animals would have saved us much suffering, but that information was not then available.

Six miles and a half east of Prince River is a bold rocky point of well-foliated red and green gneiss, striking N. 40° W. and dipping S. 50° W. at an angle of 60°.

Calcareous conglomerate. At a point three miles and a half further towards the north-east, the shore is composed of light-gray gneiss, behind which is a hill of coarse, red, calcareous conglomerate or arkose, composed of an allotriomorphic groundmass of calcite, in which are imbedded irregular grains of quartz showing uneven extinction and in many places fractured, a few flakes of mica, particles of hornblende, limonite and epidote. It strikes N. 80° W. and dips S. 10° W. at an angle of 25°.

Thinly foliated schist. For the next seven miles the land is rocky, and is largely composed of more or less thinly foliated gneiss, striking along the shore and with nearly vertical dip. At the end of the above distance is a valley a quarter of a mile long, on each side of which are hills, 150 feet high, of light-gray biotite-gneiss which strikes N. 77° E. and dips N. 13° W. at an angle of 60°. The valley runs S. 70° E. and descends seventy feet in its length. It has been comparatively recently occupied by a small glacier, a lateral moraine of boulders lying near the foot of each rocky wall. The summits of the hills are scored by glacial grooves running south.

For a short distance south-westward from this little valley, the shore is high and rugged, the points being composed of similar gneiss, which gradually swings round until it strikes southward out into the lake, and dips westward at an angle of about 45°. The land then becomes lower, and the beach is largely composed of boulders, with occasional outcrops of gneiss. At the point five miles north-east of the little valley the thinly foliated gneiss is cut by a greenstone dyke.

At the mouth of a brook, three miles north-east of this point, is a north-fractured red and green, highly calcareous quartzose-schist, dip-

ping westward at an angle of 15° , interbedded with layers of dark-green fine-grained diorite, the hornblende in which is largely altered to chlorite.

From the brook north-eastward for several miles, a ridge several hundred feet high, rises by a grassy slope from the edge of the water. At a point four miles from the brook is an outcrop of red sandstone and conglomerate striking $S. 20^{\circ} W.$, and dipping $N. 70^{\circ} W.$ at an angle of 45° . Red sandstone.

In the bottom of a bay, eight miles further east, a brook thirty yards wide flows over boulders and ridges of gneiss into the lake. Its banks are twenty feet high, and are of gray till filled with boulders. The rock, a well foliated red and gray gneiss, strikes $N. 85^{\circ} E.$, and dips $S. 5^{\circ} E.$ at an angle of 60° . The glacial grooves on its surface trend $S. 15^{\circ} W.$, the northern sides of the bosses being smoothly rounded, while the southern sides are rough and broken.

In the high rocky ridge south of the brook, the rock is a dark-green thinly foliated garnetiferous hornblende-gneiss, striking $S. 80^{\circ} W.$ and with almost vertical dip. This gneiss strikes along the northern shore; but at the foot of the steep hill, and extending downwards towards the edge of the water, there may be seen in places a band of red limestone, often brecciated, and including fragments of schist, &c. The width of this limestone band could not be determined, for its southern side was not seen. Limestone band.

The island opposite, about a mile and a half long, seemed to be composed chiefly of red stratified rock, probably sandstone, dipping at a low angle towards the south. At its eastern end is a high rounded hill composed of a massive red mica trap, consisting of a small amount of a fine-grained groundmass reddened by minute particles of iron ore, through which are scattered many minute lath-shaped crystals of feldspar (plagioclase?), many large phenocrysts of biotite, a few large phenocrysts of orthoclase, some long crystals of apatite, and some small masses of hematite. Red mica trap.

All the adjoining islands are of red rock, but as we were unable to visit most of them, on account of the shortness of time at our disposal, their exact character was not determined. A small island three miles and a half north-west of the head of the northern outlet of the lake, and the east end of the large island to the south of it, were found to consist of highly altered red sandstone and conglomerate, containing white quartz pebbles, and dipping at a low angle towards the rugged hills of gneiss on the north shore. Red sandstone and conglomerate.

At the head of the northern outlet of Baker Lake is a conspicuous rocky hill a hundred feet high, composed of well banded red and green gneiss, often highly garnetiferous, striking S. 65° E. and dipping S 25° W. at an angle of 70°. A dyke or band of fine-grained dark greenstone runs through the hill parallel with the strike of the gneiss.

Bowell
Island.

Bowell Island, so called in honour of the Hon. Sir Mackenzie Bowell, lies to the south, with its high rocky shores which round down gently into the water.

Incoming
tide.

On the evening of September 6th we entered the northern outlet of Baker Lake, but we had not proceeded far before we were met by an overfall or rapid, down which the water was flowing towards us. For a moment it seemed as if we must have taken the wrong course, but we soon recognized that we had met the incoming tide, though the water was quite fresh. The tide therefore appears to ascend as far as Baker Lake, though it does not appreciably affect the level of the lake itself.

Rocky gorge.

The river flows in the bottom of a rocky gorge from 200 to 500 yards in width, on the north side of which are rugged broken cliffs, between 200 and 300 feet high, rising from the edge of the water. The rock is a hard, brittle, well banded, green gneiss, striking down the gorge, interlaminated with bands of dark greenstone, and also cut across the strike by narrow dykes of the same rock. The south shore is also high, but the hills are more evenly rounded, and the lower part of the slope is commonly grassy. A few willow bushes grow on the rocky slopes. The sides of the rock are well smoothed and glaciated, the grooves running straight down the valley. The movement of the glacier would seem to have been eastward, as the western sides of the knolls are rounded, while the eastern sides are rough and broken. On a small island near the mouth of the river the rock is a similar banded gneiss striking S. 85° E., and dipping N. 5° E., at an angle of 60°. It is very much crushed, the grains of quartz and felspar being all roughly angular, approximately equal in size, and showing fine foliation. It is cut by a dyke, about a hundred feet wide, running S. 63° E., of fine-grained dark-gray garnetiferous diorite.

Glacial striae were apparent running S. 15° E.

CHESTERFIELD INLET.

Character.

Chesterfield Inlet was entered just below the above-mentioned island. It is a long, narrow fiord extending 125 miles westward from the north-west coast of Hudson Bay. Including Baker Lake it has a total length of 210 miles. On each side are bare, rocky slopes,

usually from 100 to 200 feet high. No soundings were taken by the writer, but the greatest depth marked on Captain Christopher's chart, made in 1762, is forty fathoms. At its upper end, just east of Bowell Island, the tide was found to rise six feet, while at its mouth the rise of the spring tide is about eighteen feet.

At a low point on the north shore, in latitude $63^{\circ} 58' 26''$, and a mile and a half below the mouth of the river just descended, the rock is a coarse gray garnetiferous gneiss, striking $N. 77^{\circ} E.$, and dipping $N. 13^{\circ} W.$ at an angle of 70° , the garnets being often aggregated in large oval masses, around which the foliae curve. We found, lying on the shore and probably derived from the rocks of the vicinity, a small boulder of granite containing a mass of copper-pyrites.

The surface of the gneiss at this point was scored by three sets of glacial striae. The earliest set, found in protected grooves on a sloping surface, run $S. 65^{\circ} W.$ The surface generally is smoothed, and well marked by glacial grooves running $S. 3^{\circ} E.$, the direction of motion being quite evident. A still later set runs $S. 43^{\circ} E.$, but this glaciation has not been sufficiently severe to rub out the former, except on the very summits of the knolls.

Three miles farther east, on the same shore, is a low point of thinly foliated green gneiss, cut across by a dyke of reddish granite or diorite, which is very much crushed and altered and in which a schistose character is developed. In thin sections the quartz and much of the felspar is seen to be broken into minute fragments, among which are scattered some rather large broken masses of felspar, chiefly plagioclase.

Four miles north-east, across the mouth of a bay that extends a long distance towards the north, we landed at an island lying off Flat Point. It was found to consist of rather coarse red and gray banded biotite-gneiss, striking $N. 37^{\circ} E.$, and dipping $N. 53^{\circ} W.$, at an angle of 45° , cut by anastomosing veins of coarse red pegmatite. Its surface is scored by glacial grooves bearing $S. 17^{\circ} W.$

Two miles and a half further south-east, along the north shore, is a low island, the northern part of which consists of massive red granite, while its southern part is of a coarse gray gneiss, striking as before, but dipping south-eastward at a high angle. Two miles further down the shore the gneiss is again dipping north-westward at an angle of 60° .

Three miles and a half further east is a rounded point of typical reddish-gray biotite-gneiss, rather irregularly foliated, but seeming to have a general strike about $N. 80^{\circ} E.$ The surface is well glaciated,



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with grooves and striae trending S. 23° E., the direction of motion being unmistakable.

Waterslightly
brackish. The water in the inlet here begins to be slightly brackish.

From this point, for seventeen miles down the Inlet, as far as Ragged Point, the shores are composed of rather high rounded bare hills of light-gray gneiss, occasionally cut by dykes of dark greenstone. At Ragged Point the gneiss is intersected by veins of coarse white muscovite-granite. The surface is also strongly scored by glacial grooves and striae bearing S. 17° E.

Coarse red
granite.

On the north side of Promise Island is a rounded hill or ridge 300 feet high, of a somewhat coarse massive red granite, containing but a small amount of biotite. Just south of the granite is a hill of dark mica-schist, associated with gray gneiss, intersected by veins of coarse white granite. Narrow dykes of dark greenstone cut both the granite and the schist.

The shore north-east of Promise Island, and as far east as West Point, consists largely of the same granite, but some of the hills had the appearance of being composed of the light-gray gneiss. The south shore, possibly on the northern side of Farther-hope Island, seemed to be composed of gray gneiss.

Sterile rocky
hills.

Below West Point we ran down with the tide, but against a stiff head wind, to a low point east of Dangerous Point. At the turn of the tide we put ashore, for it was useless to attempt to travel against both wind and current. The shore everywhere consisted of utterly sterile rocky hills of red granite or light-gray gneiss. At the place where we landed the rock is red granite, inclosing masses of gray gneiss. The glacial striae run S. 20° E.

When the tide began to ebb we continued down the rock-bound inlet, and camped in a little cleft on a dark rocky island, three miles north-west of Merry Headland. The rock was dark- and light-gray biotite-gneiss, striking N. 55° E., and with almost vertical dip. The glacial striae were here found to have turned towards the coast, running S. 50° E., down the inlet. The next day, September 10th, we travelled eleven miles against a stiff head wind, through the mist and drizzling rain, until the rising storm drove us ashore on a high rounded island of biotite-gneiss, cut by granite veins, and contained inclusions of dark hornblende-schist.

Seven miles south-east, on a high hill of light-gray biotite-gneiss cut by veins of coarse red pegmatite, an observation for longitude was taken. On the summit of this hill are distinct glacial grooves trending S. 86° E.



Sept. 9, 1893.

NORTH SHORE OF CHESTERFIELD INLET.
(Well glaciated gneiss.)



J. B. TYRRELL. Photo, Sept. 20, 1893.

ROCKY SHORE OF HUDSON BAY, WEST OF TERM POINT.

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At Peter's Cairn, three miles farther east, we were again storm-bound for most of a day, and during this time Mr. J. W. Tyrrell made a full collection of the plants of the vicinity. The hills are very similar to those farther up the inlet, being well rounded and almost utterly bare. The rock is a gray biotite-gneiss striking S. 10° W. and dipping S. 80° E. at an angle of 45° , cut by many veins of fine-grained red granite, and coarse red pegmatitic granite, so that the rock has often the appearance of fragments of gneiss, inclosed in a network of granite. On a point of similar gneiss, north of Spurrell Harbour, the surface is strongly scored by glacial grooves trending S. 45° E. Peter's Cairn.

At the rocky point south-east of Spurrell Harbour, which is at the southern entrance to Chesterfield Inlet, we were again delayed for most of a day by heavy winds, and observations were taken for variation of the compass, latitude and longitude, the latter to determine the distance that we had travelled eastward since leaving the forks of Doo-baunt River. The latitude was found to be $63^{\circ} 20' 10''$, and the variation of the compass 10° W. The point itself is a long gentle slope of smoothly glaciated biotite-gneiss, often with almost horizontal lamination. Like that previously described, it is cut by veins of fine-grained red granite and coarse pegmatite. Above high-water mark is a sandy terrace, on which is an old Eskimo camping ground, with the bases of igloos sunk a foot or two into the sand, and piled round with rings of stones, while around are many large slabs of stone in a vertical attitude, looking like gravestones in a cemetery. Spurrell Harbour.

HUDSON BAY.

For six miles south of Chesterfield Inlet, the shore is rocky, and rises more or less gently back to hills of gray gneiss. Opposite Fairway Island is a low sloping point of light-gray gneiss, striking along the shore, cut by a boss of coarse dark-green hornblende-rock holding a large quantity of pyrite. Both rocks are cut by veins of coarse red granite. The glacial grooves here run S. 55° E. South of this point the character of the shore suddenly changes, and for eighteen miles it is composed almost entirely of rounded transported boulders of granite, gneiss, etc. These frequently extend south-eastward into long low points. In the bottoms of the bays the boulders are usually piled in even walls, behind which the land rises gradually to rounded terraced grassy hills. Rocky Shore.

The point north of Baker's Foreland is a long narrow bare ridge of gray gneiss, contrasting strongly with the surrounding shore of sand and boulders. The gneiss is cut by wide veins of coarse white pegma-

titic granite. The surface of the rock is smooth and polished, but is not strongly scratched or grooved, though any grooves that were seen trend S. 35° E.

Baker's
Foreland.

Baker's Foreland consists of high points of boulders extending into shallow water. From Baker's Foreland south-westward for fourteen miles, the shore is mostly low and composed of boulders of red and gray gneiss, which frequently extend as long low points into the sea. The land rises to a ridge of terraced grassy hills.

Huronian
rocks
commence.

At a point north-east of Rabbit Island the character of the shore changes, and dark-green Huronian schists crop out from beneath the boulders.

North of Rabbit Island is a high point, on which the Eskimos are accustomed to camp while waiting for the traders from Churchill. The point is composed of green calcareous chloritic schist, striking S. 55° W., and dipping N. 35° W. at an angle of 60°. The schist is cut by a dyke seventy-five feet wide, of massive green highly altered diabase, containing a large amount of mispickel. This diabase also outcrops along the shore, where it incloses many bands of the green schist. The glacial striae here trend S. 20° E.

From this point south-westward for four miles and a half, to the mouth of Rankin Inlet, the shore is rocky, being composed of green chloritic schists, striking as before. The islands lying out towards Marble Island seemed to be composed of the same rock.

Long shoal.

At the point north-east of Rankin Inlet, a shoal covered with boulders extends a long distance out to sea, and obliged us to keep our canoes a mile from land. When we rounded this shoal, and again drew in to the land, we found it still composed of green chloritic schists, but they had turned and were striking N. 75° W., with dip S. 15° W., about 60°.

Rankin Inlet.

Thence westward for twenty miles, along the north shore of Rankin Inlet, the points and islands are composed of green schist, but the bays are shallow and lined with boulders. Behind the beach are low grassy hills, with bosses of rock projecting here and there through the turf.

Altered
diabase.

Falstaff Island is high and rounded, and consists of a light-green rock, probably an altered diabase, showing very distinct concretionary structure, the face of the rock presenting the appearance of large oval masses piled together as closely as possible. Many veins of white quartz intersect the diabase.

A low bare island in the mouth of the inlet, on which we landed in crossing from shore to shore, is composed of light-green chloritic schist,

probably an altered elastic rock, striking N. 65° W., with vertical dip, but also with a vertical slaty cleavage striking N. 25° W. Associated with this schist is a massive green altered diabase or gabbro. The surface of this island is strongly glaciated. The west side and the higher points are scored in a direction S. 70° E., but some of the depressions showed strong groovings S. 38° E. Well marked cross-fractures clearly indicated the direction of motion of the ice.

The high rocky islands seemed to be confined to the north side of Rankin Inlet, one lying west of the course travelled being especially conspicuous. The south side of the inlet is also rocky, but the country farther south appeared to be composed of till and boulders.

The point, a mile and a half south of Cape Jones, consists of light-gray biotite-gneiss, heavily and almost horizontally foliated, traversed by occasional thin bands of mica-schist, and cut by many veins of red granite and quartz containing pyrite. The surface is strongly scored by glacial grooves, the last and general set bearing S. 65° E., while an earlier set bears S. 20° E.

From a short distance south of Cape Jones the shore is low and composed of boulders, while grass-covered country, probably underlain by till, extends back to low hills. Through the rounded surfaces of these hills jagged knobs of rock, probably gray gneiss, occasionally project. Shoals, or low ridges of boulders, extend long distances out from shore, so that it was usually impossible to travel in our canoes within a mile of the high-water mark.

The rock at the point south of Corbett Inlet is a massive green fine or medium-grained diabase, which is now almost entirely altered into a mass of chlorite, epidote, zoisite and calcite. It has a clearly marked spheroidal structure, being composed of ovoidal masses, from two to three feet in longest diameter, separated by narrow, lighter coloured bands of rock of very similar composition. Here and there bands of rounded nodules, from four to eight inches in diameter, traverse the rock quite independently of the ovoidal masses, two or three of the former often lying in one of the latter. This diabase is cut by many small veins of quartz and calcite, which contain large quantities of pyrite, arsenopyrite and chalcopyrite.

At one place the diabase was seen to inclose a band, 45 feet wide, of light-green elastic quartzose schist, striking N. 65° E., and with vertical dip; while other bands of similar, but more chloritic schist, were seen on the south side of the point. The surfaces of these rocks are almost everywhere smoothly rounded and polished. The harder

portions show clear glacial grooves and striae trending S. 75° E., the direction of glacial motion being distinctly indicated by the rounded western sides, and the broken eastern sides of the knolls.

Rock-disintegration.

One of the most interesting styles of rock-disintegration in northern latitudes is here very well shown. The diabase is cut by jointage planes into large angular blocks. On or near the summits of the bare rocky hills many of these angular blocks, especially those which are smaller at the bottom than at the top, have been lifted straight up by the freezing and thawing of the water beneath them, and the subsequent contraction and expansion of the ice. They have then been supported by fragments of rock that have fallen between the sides of the blocks and the surrounding rock. Each winter the large angular blocks are raised higher, and the supporting stones fall into new positions, or are replaced by larger ones. Thus these blocks are often raised several feet above and out of the surrounding rock, and beneath them, in the hole from which they have been lifted, there is usually a pool of clear water.

Pistol Bay.

From the point south of Corbett Inlet around to the north side of Pistol Bay, the shore is composed of dark-green diabase or gabbro, intersected by bands of highly crystalline light-green quartzitic schist. At one point at which we were delayed, on the north side of Pistol Bay, this schist strikes S. 85° E., and dips N. 5° E., at an angle of 45°. The surface here shows strong glacial striae trending S. 55° E.

Term Point.

Lying out in Pistol Bay, between two and three miles from its northern shore, are several islands of light-gray massive granite. From these islands an almost direct course was taken for fifteen miles across the mouth of the bay to Term Point, which was found to be composed of dark-gray mica-schist, probably of Huronian age, striking S. 25° E., and dipping S. 65° W., at an angle of 60°. It is cut by bands of light-gray gneissoid granite, and dark-green diabase.

From Term Point westward the shore is rocky, and the steep rocky cliffs descend into rather deep water. The rock is a dark-green diabase almost entirely altered to saussurite, and is cut by many veins of quartz and calcite, holding copper-pyrites.

In the bottoms of the bays the line of high tide is marked by sandy beaches, and fifteen feet above these are other similar beaches covered with shells which are still remarkably fresh, and still higher up the slope are other similar raised beaches which exhibit a freshness that is quite startling to one coming from a more southern country, where erosion and decay are very much more rapid.

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GEOLOGICAL SURVEY OF CANADA.

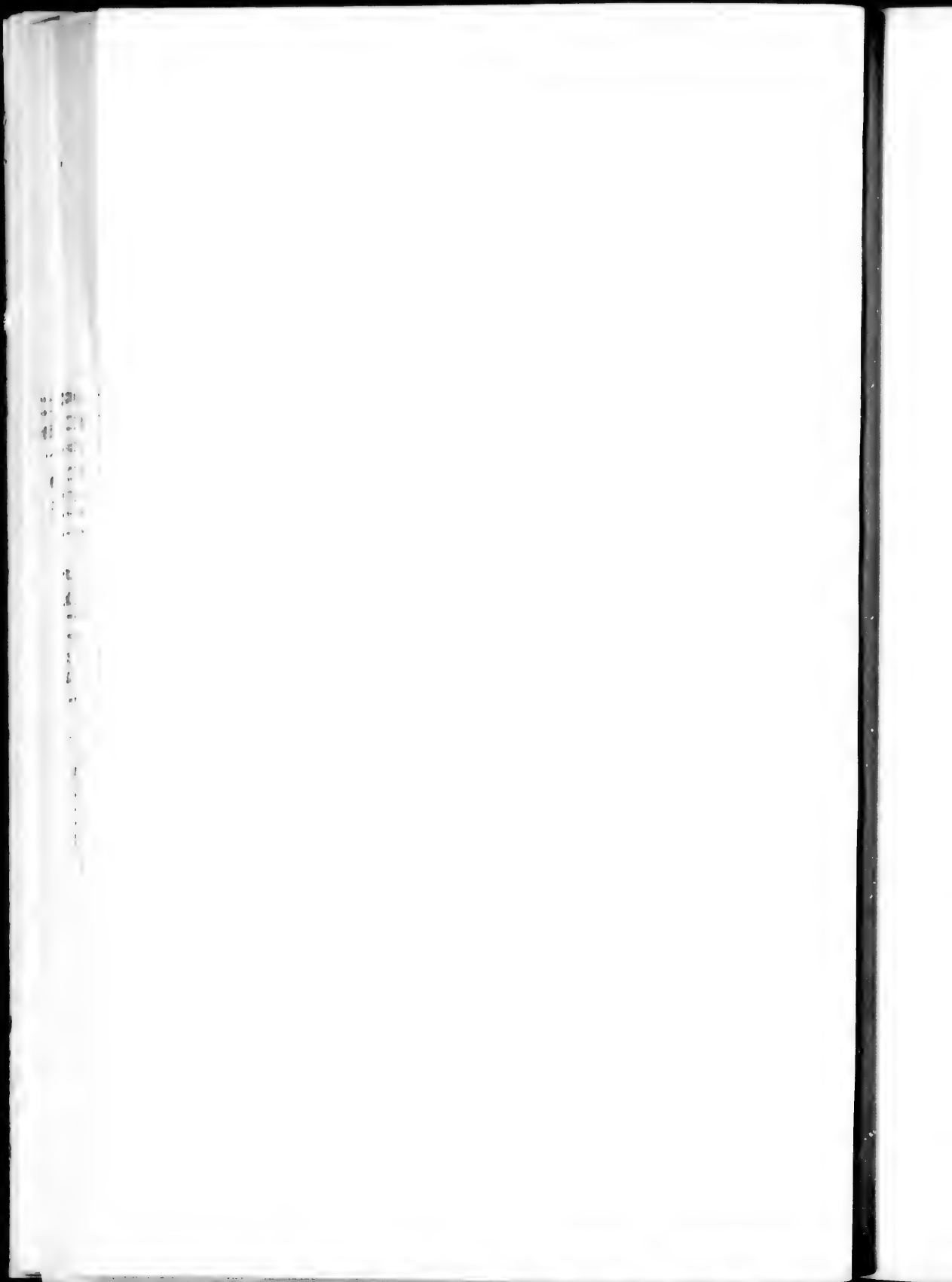


J. B. TYRELL. - Photo, Oct. 13, 1894.

SUMMIT OF RIDGE OF QUARTZITE, BEHIND CHURCHILL.

Large mass of rock heaved by the frost.

VOL. IX., PART F., PLATE VII.



On the northern shore of Mistake Bay, nine miles west of Term Point, is a long point of similar green diabase. Seven miles further south-west, about the middle of the west shore of Mistake Bay, is a high point of similar dark-green diabase, containing, in many places, a large amount of copper-pyrites, and cut by small veins of quartz studded with iron-pyrites. Along the shore are many angular fragments of a dark-green, highly altered rock, now composed of chlorite, hornblende and magnetite, but the parent bed was not seen. The surface is everywhere well scored by glacial striae trending S. 42° E.

A mile farther south, on the south side of the last-named point, low hills of white, or light-pink Huronian quartzite, stretch away to the south. This quartzite is rather thinly and evenly bedded, and the bedding-planes frequently show ripple-markings. The strike is N. 88° E., and the dip S. 2° W., at an angle of 75°. The character of the contact of this quartzite with the adjoining highly altered diabase was not determined.

Three miles south of the point is a remarkable flat-topped island, bounded by cliffs about forty or fifty feet high. It is composed of sand and coarse rounded gravel, and extends as a long, narrow, and almost horizontal ridge. As seen from the canoes it had the appearance of having been an esker which had subsequently been levelled off by wave action, at the time when some of the raised beaches around the bay were formed.

Opposite this island, and as far south as Neville Bay, the shore is low and shallow, and low points of boulders extend a long distance into the shallow water.

On the north side of the mouth of Neville Bay low glaciated bosses of reddish-gray gneiss crop out below high-water mark, while the low hills behind are morainic accumulations of boulders, that have been modified and slightly terraced by the subsequent action of the sea. These morainic hills extend for a couple of miles along the north shore of Neville Bay, north-west of which, for several miles, the shore of the bay consists of smooth, bare hills of greenish epidotic gneiss, between which are small till-covered areas covered with black lichen (*Alectoria divergens*). Beyond these hills is an open sandy and gravelly country, rising in regular terraces to heights of about a hundred feet above the sea, beyond which, near the mouth of Ferguson River, the country is again characterized by bare rocky hills of gneiss.

From the mouth of Ferguson River to Churchill, we travelled along the shore both in 1893 and 1894, but on both occasions the journey was made with as few stops as possible, and these only at high tide,

and in the former year the ground was thickly covered with snow, so that it was impossible to obtain more than a very general idea of the geology of the country.

ille Bay. The south-west side of Neville Bay is usually rather low, with long points of boulders extending out from it into shallow water. Sir Bibby Island is a large, low island of till and boulders, and between it and the shore is a narrow shallow channel, probably dry at low tide, with a bottom of boulders. From this channel southward, for a short distance the shore is low and strewn with boulders, and then it becomes very bold and rocky.

Two miles south of Sir Bibby Island is a prominent rocky point, with a high rocky island lying a short distance off it. This point is composed of light- and dark-green diabase or gabbro, while the rock on the island shows a slaty cleavage and breaks into long thin slabs.

From this prominent point the shore turns westward and is bold and rocky, being composed of dark-green fine-grained diabase, studded with copper-pyrites.

Dawson Inlet. Dawson Inlet, lying to the west of this point, must be thirteen miles or more in depth, as we could not see to the bottom of it from the tops of the hills on the north shore. We crossed the mouth of this inlet to two islands, on which are long hills of sand and boulders. From these islands south-westward for several miles, the shore is low and thickly strewn with boulders. Here and there it becomes very flat and sandy. Behind this sandy plain is an old beach, fifteen feet above the present one. A short distance further inland are a number of narrow ispatinow-like ridges of gravel and boulders running S. 50° E., parallel to the direction followed by the Keewatin glacier towards Hudson Bay.

Point 6 miles
S.W. of Wal-
lace River.

Six miles south-west of the point at the mouth of Wallace River, where we were delayed for five days in a storm, the tide runs out for a couple of miles, leaving behind it a wide sandy flat, studded with boulders, and partly covered with ropy seaweeds. Behind the beach is a wide grassy flat, dotted with small lakes, which extends back a couple of miles to the foot of an escarpment about thirty feet high, of sand and gravel. On top of this escarpment is a sandy plain without boulders. Near the shore are some low bosses of gray biotite-gneiss, rather irregularly foliated in a general north-east and south-west direction, and cut by many veins of red granite. Against the gneiss, though the exact contact was not observed, lies a band of rather thin-bedded white and pink Huronian quartzite striking N. 50° E., and with vertical dip. The surfaces of the beds are often strongly ripple-

marked. Sixty feet of quartzite in all is exposed. North-west of the quartzite band is a low strip of land, about 200 yards wide, in which no rock exposures were seen, and beyond it is a band of green siliceous schist, probably also of Huronian age, dipping and striking the same as the quartzite. The schist is much jointed, and many angular blocks of it have been heaved out of their places by the frost.

From this place southward for many miles, no rock in place was seen, but the shore is very flat and strewn with boulders, and the tide at low water runs out several miles. In north latitude $61^{\circ} 18'$ is a prominent cape, consisting of two high morainic ridges of boulders, from which extensive shoals of boulders stretch seaward for several miles. South-west of this point is a group of hills, apparently morainic ridges and eskers.

Cape Esquimaux is a narrow esker-like ridge several miles long, trending $S. 73^{\circ} E.$, with a deep but narrow bay on each side. The scarped end of the point shows the cut face of a terrace twenty feet high, the lower part of which is of sandy till, full of boulders, while the upper part is of stratified sand. On the summit of the cape, near the point, are some small ponds of excellent fresh water, so that it is a convenient place for trading boats to stop as they travel between Churchill and Marble Island.

Sentry Island, lying off Esquimaux Point, appeared to be a long kame or drumlin, rising gently from both ends, and like so many of the ridges in the interior, with a large boulder on the summit.

The point five miles south of Esquimaux Point, is a similar long sandy ridge or esker, running $S. 73^{\circ} W.$, parallel to the last, quite narrow, and about twenty feet above high-water mark. Long bars of boulders extend seaward from the ends of both these points.

Seven miles south-westward from the latter point, in a rounding bay, we came to a low flat grassy shore, with a conspicuous drumlin-like hill half a mile inland.

On the shore, two miles south of this hill, is a low boss of red gneiss.

In north latitude $60^{\circ} 50'$, McConnell River discharges its waters in a series of little channels for a mile or two along the beach, and off the mouth of the river a very extensive shoal extends several miles out into the bay. On a level sandy plain, within the delta of the river, is a low rounded drumlin-like hill, which forms a very conspicuous feature on this portion of the shore.

For several miles south of McConnell River, a level well-grassed sandy plain extends along the shore, and then some low rounded

Absence of
driftwood.

hills make their appearance. Eight miles south of the river a brook thirty feet wide flows into the sea, at the mouth of which is a sandy spit, on which we found some drifted pieces of dry willow, which had doubtless been brought down by the brook. These were the first pieces of driftwood found while we were travelling southward down the shore of Hudson Bay. It would seem that there is a persistent current flowing southward down this shore, and any driftwood that may be brought down by streams into the sea is therefore carried in that direction, until it is thrown upon the beach out of the reach of the waves. Consequently no driftwood was found north of those rivers which had wood growing somewhere on their banks.

Four miles south of this brook, along a low flat shore, is a low boss of red granite.

Gray gneiss.

Four miles further south is the mouth of a small river, which discharges a considerable quantity of brownish water over the stony beach. Two miles further south, in approximate latitude $60^{\circ} 34'$, is a low rounded hill of gray gneiss striking S. 60° E., and dipping S. 30° W., at an angle of about 40° , but the gneiss is so intersected by veins of red granite that it is impossible to determine the dip very closely. The surface is smooth and strongly glaciated, the grooves and striae trending S. 73° W. The eastern sides of the knolls are rough and broken, while the western sides are smooth and rounded.

For a long distance further southward the shore is all low, flat and sandy, with bars of boulders lying off, and parallel to it, and not projecting out from it as before.

In latitude $60^{\circ} 7'$ is a low rocky point of red gneiss, and three miles and a half south of this point, in observed latitude $60^{\circ} 3' 31''$, some large driftwood was found on the higher points of the shore, about where it would be thrown by the heavy storms, so that it is probable that we were then in the vicinity of the most northerly stream that has heavy timber growing on its banks, though as yet there was no sign of any trees on the shore.

Four miles further south low ridges of sand and boulders began to appear along the shore, and three miles further on the country assumes a decidedly lumpy morainic appearance.

Egg Island.

Egg Island is a conical morainic knoll of boulders, lying in a gently rounded bay about a third of a mile from shore. The upper fifteen feet is covered with grass, while the rest, which is washed by the waves and tide, is a slope of naked boulders. The water between

the island and the shore seems to be deep, and there is a moderately high morainic ridge of boulders on the shore opposite it.

For five miles south of Egg Island the country consists of low rough hills of boulders, and the beach is composed entirely of boulders. It was so steep that at half ebb we were able to pass in our canoes within one or two hundred yards of flood tide mark.

Here was a point that had been conspicuously marked by the Eskimos, for some of these people had raised a large drifted tree-trunk into an upright position on its summit, and had supported it there with heavy stones. The point is underlain with a coarse red granite, with a well rounded, roches moutonnées surface. It is scored by distinct glacial striae trending S. 15° E. A few glacial grooves were also seen trending S. 30° E., but whether earlier or later was not determined. The boulders lying about are almost entirely of granite and gneiss, but a very few pebbles are of Palaeozoic limestone.

Point of red granite.

The shore to the south continues to be strewn with boulders, though here and there the smooth granite or gneiss descends into the water. Six miles south of the Stanley-stick Point is a knoll of medium-grained red biotite-granite, the surface of which is smoothly rounded on its western and broken and jagged on its eastern side. It shows many irregular glacial scratches, but one strongly marked set of parallel grooves trends S. 60° E.

In latitude 59° 28' 8" is a point of rather fine and even-grained rusty red granite. In places the rock descends steeply into the water, and the point is probably a good landing place for small boats at any stage of the tide. At extreme storm-tide mark, a large quantity of driftwood is scattered on the shore, some fine large trunks of white spruce among the other smaller fragments of wood.

Hubbart Point, several miles farther south, is the most easterly one of a number of stony morainic hills which extend southward for several miles, separated by tidal flats. The top of this hill, which is about forty feet above high-water mark, is moderately well grassed. On it are many stone mounds, evidently Eskimo graves, on and beside which are numerous spears, kettles and other articles that have belonged to the Eskimos while alive, and have been left here with the bodies by the surviving relatives. A large quantity of driftwood had also been collected and piled up by the Eskimos on this point.

Hubbart Point.

Here Captain Luke Foxe landed in 1631, 263 years before our first visit, and the description of it given by him would very well characterize the place as it appeared to us. In the distance towards

the south-west is an escarpment or ridge of hills. With the field-glass this ridge was seen to be wooded with a coniferous forest, being the first trees that we had seen for many weeks.

Willows begin to appear.

South of Hubbard Point clumps of willows begin to appear on the shore. Some low, bare, rounded bosses of grey gneiss were seen near the edge of the water, but though the surfaces were smooth and polished, the snow made it impossible to determine the exact direction of glaciation.

Thence southward and eastward, to the bottom of Button Bay, the shore is low and flat, with a rather higher ridge in the background. At low tide a wide mud-flat, covered with boulders, extends seaward for several miles. Trees, chiefly small white spruce and larch, gradually approach the shore, until, at the bottom of Button Bay, the forest reaches to within a short distance of high-water mark.

PORT CHURCHILL.

Position.

The trading store and mission at Churchill are situated on the west side of the tidal lagoon at the mouth of the Churchill River, on an old sandy beach a few feet above high-tide level. Back of this old beach, which is between 100 and 200 yards in width, steep bare rounded hills rise to a height of 80 to 100 feet, forming part of the rocky ridge which extends along the west side of the river for several miles, out to the extreme end of Eskimo Point at the old fort, forming the bold promontory between the river and the east side of Button Bay. A similar rocky ridge also forms the east side of the mouth of the tidal lagoon, and thence extends eastward for a number of miles along the shore of Hudson Bay towards Cape Churchill.

Character of rock.

The rock is a greenish-gray even-grained, false-bedded, felspathic arkose sandstone, in places very massive, and in other places more thinly bedded, often cut by many irregular veins of dull white quartz, which contain a large quantity of magnetite. At the rocky point below the mission it strikes N. 45° E. and dips S. 45° E. < 70°. In the hill south of Sloops Cove it strikes N. 55° E., and dips S. 35° E. < 20°, with ripple-markings showing on the planes of bedding. At the mouth of the river, near old Fort Prince of Wales, it strikes N. 65° E., and dips S. 25° E., < 70°. Its clastic character is everywhere apparent, and here and there, scattered very irregularly through the beds, it contains well rounded pebbles, some of which are as large as the fist, of white clastic quartzite similar to the Huronian quartzite of Marble Island. The occurrence of these quartzite pebbles appears to associate this Churchill arkose with the red Athabasca con-

glomerate, with its white quartzite pebbles, which has been correlated with the Keweenaw rocks of Lake Superior. The Churchill rock has been much more disturbed and altered than the Athabasca conglomerate, but that may be due to quite local conditions.

In a fissure, along the lines of bedding of this arkose, on the south-east side of the rocky point below the mission, protected from any of the three glaciations shortly to be described, is, or was, a small outlier of a unaltered Cambro-Silurian limestone containing a few cubic feet. It is mainly composed of the following species of corals, which seemed to be in the same position in which they originally grew on the surface of the arkose, *Columnaria alveolata*, Goldfuss, *Favosites Gothlandicus*, Lam., and *Calapœcia Canadensis*, B. Scattered among the corals are fragments of the following shells: *Dinobolus magnificus* (?) B., *Rhynchonella*, probably *R. inequivalvis*, Castelnau, or *R. Anticostiensis*, B., *Orthoceras*, fragments of two or three small species, one marked with minute longitudinal ridges; *Actinoceras*, probably *Richardsoni*, Stokes, or *Bigsbyi*, Brown; *Cyrtoceras* sp., apparently the same as one from Little Black Island, Lake Winnipeg; *Iliaenus* sp. Scattered along the shore in the vicinity are many boulders of thin-bedded white limestone of about the same age, containing the following fossils, viz.: *Calapœcia Canadensis*, B., *Columnaria alveolata*, Goldfuss, *Streptelasma robustum* (?), W., *Halysites catenularius* var. *gracilis*, Hall, *Dinobolus parvus*, Whitfield, *Rhynchonella*, sp., *Lophospira bicincta*, Hall, *Pleurotomaria* or *Trochonema* sp., *Maclurea Manitobensis*, W., *Orthoceras* or *Actinoceras* sp., *Pterygometopus callicephalus*, Hall.

With the above are associated some fragments of white Silurian limestone like that of the Grand Rapids on the Saskatchewan River, holding *Pentamerus decussatus*, W., in abundance, with *Pterinea* sp., the same as the species from Grand Rapids, *Pleurotomaria* sp., *Gomphoceras parvulum*, W., and an Ostracod which Professor T. Rupert Jones has determined as being probably identical with *Leperditia Selwynii*, Jones, from the Silurian of Anticosti, but also as being very similar to *Leperditia caeca*, Jones, from Grand Rapids.

In and around the old fort at the mouth of the river, are many boulders of heavier-bedded Trenton limestone containing large *Orthoceratites* very like some of those from the Trenton of Manitoba. These latter boulders have probably been transported along the shore from some outcrop of limestone farther towards the east.

The bare quartzite hills have rounded roches moutonnées surfaces, but unlike the hills further north along the shore of Hudson Bay, they are planed and scored on every side, instead of being on one side smoothly

Cambro-Silurian limestone.

Fragments of Silurian limestone.

Well-glaciated surfaces.

Three
glaciations.

rounded and on the opposite side jagged and broken. This evenly rounded character is caused by the rock having been travelled over by two or three different glaciers coming from different directions, each planing down the surface which faced it. Two of these glaciers have left markings which are very distinct and unmistakable.

Last
glaciation.

The last glacier came from the north, and left grooves and striae varying from S. 5° E. to S. 5° W. All the summits and rocky hillsides sloping towards the north are smoothed and scored by this glaciation and all traces of previous glaciation are there obliterated. Salient points on eastern and western slopes are also scored by glacial markings trending south, overrunning and rubbing out the other earlier markings, which, however, have been left in the depressions. A short distance behind Cocle Point there is an almost vertical face of rock, running north-and-south and looking westward over a low wide grassy flat, which is strongly grooved horizontally by this glaciation, to the exclusion of any other glacial markings. The direction of flow of this last glacier is clearly shown by the absence of this set of grooves on southern slopes, and by the presence in the grooves of numerous cross-fractures opening southward.

This glacier was evidently a southern continuation of the one which farther northward flows south-eastward and south-southeastward to the west coast of Hudson Bay from its névé ground in the vicinity of Doobaunt and Yath-kyed lakes.

Second
glaciation.

The evidence of another glacier earlier than the one just described is also very distinct. Southern slopes, and those portions of the summits and western slopes protected by projecting bosses of rock from abrasion by the glacier from the north, are beautifully planed and strongly scored by glacial markings running N. 45°-55° E. The direction of flow of this glacier is clearly shown by the strong glacial markings on the protected south-western slopes, the grooves being constantly crossed by curved fractures opening towards the north-east, and the absence of this set of grooves on eastern slopes, however favourable these slopes might otherwise be for their preservation. The glacier that made these markings flowed north-eastward from the higher ground down into Hudson Bay, being perhaps a local glacier following the general course of the Churchill River, at the beginning of the last glacial period.

First
glaciation.

The evidences of a still earlier glaciation are much less distinct, for all traces of it have been swept from northern, western and southern slopes, and from every rocky projection. But on protected parts of hillsides looking eastward towards the river, are many well planed surfaces strongly scored by a parallel set of glacial groovings trending

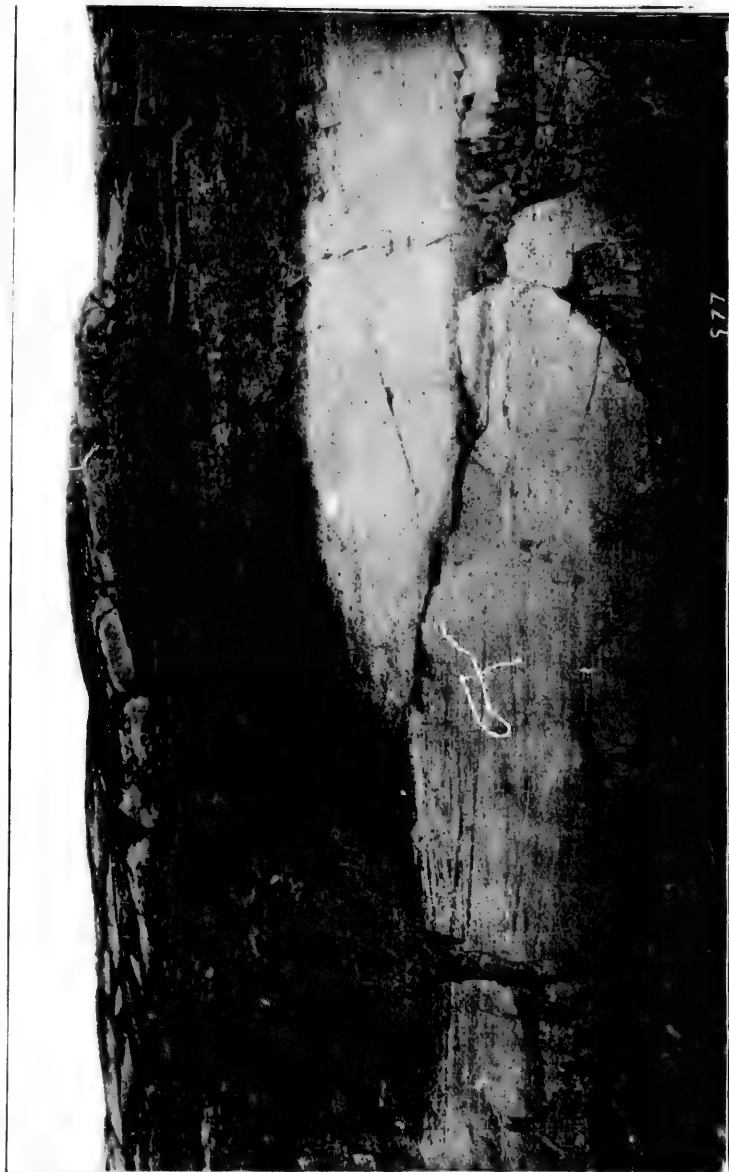
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J. B. TYBRELL. Photo. Oct. 13, 1894.

CHURCHILL QUARTZITE, VERTICAL SURFACE FACING WESTWARD.

Showing grooves and striae made by the glacier from the north.

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S. 80° W. This glaciation is shown to be older than that moving towards the north-east at a number of places where surfaces scored by both sets of grooves come in contact with each other, but especially at some well protected spots on the summit of the ridge west of the trading store, where depressions, in the surface that is generally scored by glacial grooves running north-westward, are scored by the earlier set of grooves and striae pointing S. 80° W. The direction of motion of this, the earliest of the three glaciers, could not be as certainly determined as that of the other two, but pits rounded on their western and broken on their eastern sides indicate that the direction here given is correct, and besides this many of the strongly scored surfaces would almost certainly be untouched by a glacier moving in the opposite direction.

Churchill is the most northerly point on the west shore of Hudson Bay where any signs of a westward glaciation could be detected, and the groovings here were probably caused by a more or less local glacier moving westward from a névé near the shore, when the land stood somewhat higher than it does at present, possibly centring in the vicinity of Cape Churchill, thirty miles east of the mouth of Churchill River.

The transported boulders on the flats and along the shore in the vicinity of Churchill, consist chiefly of local arkose rock or of white unaltered Palaeozoic limestone, but a considerable number are of red and gray gneiss and fine-grained red granite, while a few small ones are of red quartz-porphyry. All are very probably derived from the country west of Hudson Bay.

Transported
boulders.

Gravel terraces, on the sides of the hills and up to their summits, mark old shore-lines, indicating the gradual rise of the land in post-glacial times, since it has been unburdened from its load of snow and ice.

Gravel
terraces.

Whether the land is still rising, or whether it has now reached a condition of stability are interesting questions, and since Churchill has been occupied as a trading post of the Hudson's Bay Company for nearly two hundred years, it is reasonable to expect to find here some evidence of the relative positions of land and sea a comparatively long time ago.

Rising or
stability of the
land.

In 1733, the Hudson's Bay Company began building the massive stone fortification, which they called Fort Prince of Wales, on the summit of the low point west of the entrance to Churchill Harbour. This fort is surrounded by a gravel-covered plain or terrace, and the base of its walls is now seventeen feet above ordinary spring tide, and the top of the shingle beach, that is now regularly washed by the storm-waves at ordinary spring tides, is only six feet below the base of

Building of
Fort Prince of
Wales.

the walls. If the land had been eight or ten feet lower in 1733 than it is at present, the storm-waves with high spring tides would have regularly washed over the point, and it is not likely that a structure of any kind would have been built there, for the place would have been a disagreeable and dangerous one.

In his account of Hudson Bay, published in 1744, Sir Arthur Dobbs, a man who had made himself very well acquainted with the geography of the bay, states that Fort Prince of Wales is built "upon an eminence forty feet high," * a perfectly natural exaggeration for a man looking at the fort in its present position, twenty-five feet above mean tide level, but hardly intelligible if the land was ten or twelve feet lower than at present, and if the fort was but fourteen feet above mean tide, and less than eight feet above the top of spring tide.

Robson's
map.

For several years between 1733 and 1747, Joseph Robson, an engineer, was stationed at Churchill to superintend the building of this fort. About 1746, he made a survey of the harbour and river for ten miles up from its mouth and drafted a map which was published by him in 1752.† This map shows the river at high and low water, and the rocks and low marshy ground around it just about as it is at present. A narrow neck of land, above high-water mark, connects the point on which Fort Prince of Wales is built with the main shore, a neck, the rocky portion of which, is still very little above high-water mark. The low-water mark is a quarter of a mile out from the mouth of Sloops Cove, and stony flats extend for a mile between high and low water opposite the position of the present trading post of the Hudson's Bay Company. The high-water mark was much the same then as now, and marshy ground but a few feet above the water, well shown on the old map, still extends south-west from the lagoon. A rise or fall of the land of a very few feet would change the shore-line considerably, and this old map shows clearly that no great change in the elevation of the land has taken place since it was made, about the middle of the last century.

Sloops Cove.

Sloops Cove is a little bay on the west side of the river, two miles above old Fort Prince of Wales, so called from having been the wintering dock of the small sloops kept here during the eighteenth century for the purpose of carrying on trade with the Eskimos on the west side of Hudson Bay, in the vicinity of Whale Cove and Marble Island. The cove is a hundred yards long and forty wide, and on each side are

*An account of the Countries adjoining to Hudson's Bay, by Arthur Dobbs, Esq., London, 1744, p. 55.

†An account of six years' Residence in Hudson's Bay, by Joseph Robson, London, 1752.

smooth well-glaciated rocks of green arkose, rising at first steeply, and afterwards more gently, to about twenty-five feet above high water mark. At the back, between two rocky hills, is a grass-covered bar of sand and gravel, separating the cove from a wide flat, still covered with water at high-tide, as it was in 1746. The bottom of the cove, almost up to high-tide level, is composed of a fine soft silt brought in by the river. Across the mouth is a gravel bar, through which project two low bosses of rock. Between these the water drains out of the cove as the tide recedes, leaving it dry at low tide. To the north is a larger gap which has been blocked by a dam of pieces of timber, and large masses of rock, many of which have been blasted from some place in the vicinity, perhaps from south of the knolls, where the gravel bar has since been formed.

In the gap at the mouth of the cove there is now four feet of water at high spring tide, but it is quite possible that before the dam was built, and the sand-bar formed, the entrance may have been somewhat deeper. Robson's map does not show the gravel-bars at either end, and if they did not then exist the fine soft silt that now forms the bottom would not have been there either, for the tide, rushing through the gap, would have scoured it down to the hard till or rock. Perhaps the building of the dam at the mouth of the cove, preventing this tidal scour, has been the chief reason why it has since silted up.

Depth of
water in the
cove.

It is difficult to find a good wintering place for a small vessel in Churchill Harbour, as the ice may shift and break the anchor chains and moorings and carry it on the tops of large boulders. Since a vessel would be perfectly safe when once it had been floated into Sloops Cove, considerable exertions would doubtless be made to get it there.

In addition to the sloops of the Hudson's Bay Company, local tradition has it that the *Furnace* and *Discovery*, two small ships sent to look for the North-west Passage, here spent the winter of 1741-2, and the words "FURNACE & DISCOVERY 1741," cut in the face of the smooth rock on the north side of the cove, would indicate that this tradition is correct. The *Furnace*, the larger of the two vessels, is said by Forster to have been a "sloop or bombketch," and would probably have a draught of from eight to ten feet, which could doubtless be lightened to six feet or less to take her into dock. That they were able to take the ships into and out of dock at high tide only is clearly shown by Robson's map, and also by the log of Captain Middleton, of the *Furnace*, who records that on June "9th and 10th (spring tide after the full moon of June 6th old style) got the ship out of her dock and moored her."*

Furnace and
Discovery.

* Dobb's Hudson's Bay, p. 17.

If the deepest part of the mouth of the cove can now be seen, and if the ships required six feet of water to float them into it, there would here be evidence of the rise of the land to the extent of two feet in the last century and a half, but as neither of these points are certain the evidence in favour of this rise is too indefinite to be considered at present.

Names cut on
the rocks.

On the rocky walls of the cove, planed smooth by the second glaciation from the south-west, many names have been engraved and now appear as fresh as if cut but yesterday. Among these the one of most historic interest is that of "SL. HEARNE," the discoverer of the Coppermine River, and the writer's only predecessor into the Barren Lands around Doobaunt and Yath-kyed lakes, who, on "July y^e 1 1767," two years before he started on his memorable journey to the Northern Ocean, appeared to have sat here with hammer and chisel in hand, beguiling the long hours of his tedious solitude by engraving his name among those of the masons and artisans from Fort Prince of Wales on this rocky point.

But other names are of more interest in connection with the question of the rise or fall of the land. During the winter the bottom of the cove becomes filled with ice up to the level of the highest spring tide, for at Churchill the spring rise is 15 feet 5 inches, and at times extraordinary spring tides rise to a height of four feet above ordinary spring tide level. On the 2nd of November, 1893, the bottom of the cove was covered with ice up to the level of the last spring tide, about an ordinary one, and the heights above the ice of the following names were measured and are given opposite to them:—

James Walker May y ^e 25 1753.....	7 ft.
Guilford Long May y ^e 27 1753.....	7 ft.
J. Marley, 1748.....	6½ ft.
J. Horner, 1746.....	6 ft.
J. Wood, 1757.....	6 ft.
Furnace and Discovery, 1741.....	3 ft. 3 in.

Ice in the
cove.

As the ice does not leave Churchill harbour, on an average, until the 19th of June, and has not been known to break up in it before the 5th of June, the two names first mentioned above were undoubtedly cut while the ice was in the cove at its highest winter level, which at the present time would certainly be not more than six feet below them, and the surface of the snow would probably be still higher. Since the names would in all probability be cut not less than two feet above the ice, where a man could work sitting down, and could not have been cut below the ice, the greatest probable rise of the land since 1753 is between

three and four feet, while the greatest possible rise is six feet. It does not appear in what month the names of the other men were cut, but probably in the long days of winter or spring, before the ice had gone out of the river, and the busy summer of fishing and trade had begun, in which case they would indicate a less rise of the land than that shown by the former names. The "Furnace" and "Discovery" reached Churchill in the autumn of 1741. Their names are cut in the almost vertical face of the rock, but whether they were cut before the bottom of the cove was covered with ice or not is uncertain.

Besides the evidence of the comparative stability of the land furnished by the above-mentioned names, a number of rings have been placed in the rock at various heights for the moorings of the ships or sloops. As they are all well set in the rock, they were probably inserted there by the masons at work on the old fort during the last two decades of the first half of the 18th century. Those five feet or more above the ice of November 2nd, 1893, are still firm and strong, while others two feet and a half above the ice have been almost entirely rusted away. The former have evidently been comparatively free from the influence of the salt water, while the latter have been subjected to its influence, having been wet by very high tides, and splashed by the water in heavy storms. The positions and states of preservation of these rings clearly indicate that there has been no great change in the relative heights of land and water since the molten lead was poured round them as they were set into the rock.

Rings for
mooring ships.

Through the kindness of the officer of the Hudson's Bay Company in charge at Churchill, the writer was granted the privilege of inspecting a more or less broken series of "Journals of Occurrences" extending as far back as 1824, and from them was obtained the following record of the opening and closing of Churchill Harbour. The harbour opens suddenly, when the ice breaks up in the lagoon and goes out of the river with the tide. It closes more gradually, freezing from the shore out to the middle, and the date here given, in most cases at all events, is that of the final setting of the ice from shore to shore; for some days previous to this date the shore will have been pretty thickly covered with ice.

Dates of
opening and
closing of
Churchill
Harbour.

DATES of the opening and closing of the Harbour at Port Churchill.

Year.	Open.	Closed.	Length of open season.
1824.....		Nov. 2.....	
1825.....	June 12.....	" 18.....	5 mos. 6 days.
1826.....	" 11.....	" 22.....	5 " 11 "
1827.....	" 24.....	" 13.....	4 " 20 "
1828.....	" 22.....	Dec. 1.....	5 " 9 "
1829.....	" 10.....		
1833.....	" 18.....		
1834.....	" 21.....	Nov. 15.....	4 " 25 "
1837.....		" 1.....	
1838.....	June 27.....	" 4.....	4 " 8 "
1839.....	" 21.....		
1841.....		Nov. 25.....	
1842.....	June 24.....		
1843.....	" 25.....		
1844.....	" 24.....	Nov. 23.....	5 "
1845.....	" 19.....		
1846.....	" 10.....	Nov. 28.....	5 " 18 "
1847.....	" 26.....		
1848.....	" 19.....	Nov. 6.....	4 " 18 "
1849.....		" 27.....	
1850.....		" 15.....	
1851.....		Dec. 1.....	
1852.....	June 13.....	Nov. 28.....	5 " 15 "
1853.....	" 24.....		
1855.....	June 19.....		
1856.....	" 9.....		
1857.....	" 21.....		
1858.....		Nov. 11.....	
1860.....		" 8.....	
1861.....		Dec. 4.....	
1862.....	June 7.....	Nov. 5.....	4 " 29 "
1863.....	" 5.....	" 11.....	5 " 6 "
1864.....	" 21.....	" 14.....	4 " 24 "
1865.....	" 23.....		
1866.....	July 2.....		
1885.....		Dec. 4.....	
1886.....	June 17.....		
1892.....	" 19.....	Nov. 11.....	4 " 23 "
1893.....	" 19.....	" 4.....	4 " 16 "
1894.....	" 6.....	" 19.....	5 " 13 "
Average.....	June 19.....	Nov. 18.....	5 mos.
Earliest.....	" 5, 1863.	" 1, 1837.	
Latest.....	July 2, 1866.	Dec. 4, 1861 & 1885	
Longest season.			5 " 18 days, 1846.
Shortest ".....			4 " 8 " 1838.

CHURCHILL TO YORK.

Mode of travel.

The winter journey from Churchill to York is usually made on the level land some distance back from the sea-shore. The country is almost entirely treeless, and the snow covering it is packed hard by the wind, so that men travel over it readily on small snowshoes, and the dogs and sledges rarely sink in the snow to any appreciable extent.

Farther inland the country appeared to be wooded, and in the woods the snow would be soft, and the rate of travel, both for men and dogs, consequently much slower.

After crossing the Churchill River on the ice, our course, for about twenty-five miles, was a little south of east, over level open country, interspersed with small lakes. Here and there a somewhat higher tract is wooded with small white spruce. Two ridges of sand or gravel, between twenty and twenty-five feet in height, were crossed in this distance.

At a forest known as the "Eastern Woods," we turned southward and travelled over almost level marshy country, which, in some places, is quite open, but is usually thinly wooded with small white spruce and larch. A few groves of larger spruce were seen to the west of our course. Near White Whale Lake a gravel ridge, marking an ancient sea beach, was crossed. As Salmon Creek is approached the country is covered with low scrub of dwarf birch and willow, or extends in wide grassy plains very similar in appearance to those of Manitoba east of the Pembina Mountains. Salmon Creek is a small stream about twenty feet wide, flowing between grassy or willowy banks.

Broad River, which flows through a wide, level, almost treeless, plain, is about a hundred yards wide, with low banks wooded with spruce. A few miles farther south, Owl River, eighty yards wide, flows across this same open plain.

On Stony River the woods descend to within a short distance of the sea-shore.

A short distance south of White Partridge Creek the open country ends, and we entered a forest of small white and black spruce and tamarack, the black spruce being the first that we had seen on the coastal plain. Forest begins.

White Bear Creek flows through this forest with a width of about twenty-five feet. At the mouth of Duck Creek we reached the coast, and thence followed the west bank of Nelson River as far as a point opposite Seal Island. In this latter distance the bank, which had been very flat, and but a few feet above the level of the sea, rapidly increases in height, until at Flamboro' Head it rises from the edge of the water in steep scarped cliffs 100 feet high, where it consists of unstratified light-gray till, holding striated boulders of limestone, gneiss, granite, &c. From the top of the cliff a thinly wooded swampy country extends westward into the interior.

ROUTES EXPLORED IN 1894.

CEDAR LAKE TO REINDEER LAKE.

The course followed by the party, from Grand Rapids, up the Saskatchewan River to Cumberland, has been often described by others, and its general character is well known. The geology of Cedar Lake, and of the river below it, is given in some detail by the writer in his Report on North-western Manitoba, pp. 144 E—153 E, in the Annual Report of the Geological Survey of Canada, Vol. V. (N.S.), 1890-91.

A few notes may here be recorded on the river above Cedar Lake.

Saskatchewan
River.

From Cedar Lake to The Pas, a distance of seventy-six miles, the river, often broken into several channels, flows through a wide marshy plain or lowland. No hills break the level monotony of this vast plain except at Pine Bluff, where three or four wooded ridges approach the river. They seemed to trend in a south-westerly direction, and are probably drumlins, though it was impossible to spare the time to go and examine them. The river banks everywhere are composed of fine stratified alluvial deposits, as far up the stream as the eastern limit of the Pas Indian Reserve, where the first stony bank slopes to the water. It is composed of a light-gray rather friable unstratified calcareous till, filled with irregular subangular pebbles and somewhat rounded boulders polished and scratched with glacial markings. The boulders are almost all of a pinkish Cambro-Silurian limestone containing crinoid stems, &c. This sometimes varies to a limestone conglomerate, occasionally with a sandy matrix. There are also a few boulders of red and gray gneiss, massive hornblende-rock, etc.

Pas Ridge.

At the Pas mission house, the low ridge, which rises fifteen or twenty feet above the water, is composed entirely of similar till. Four miles above the Mission a hill or ridge approaches to within a quarter of a mile of the north side of the river. It runs N. 50° E., and rises seventy feet above the level of the flat country to the west. In ascending it a terrace is met with at the height of thirty feet, and the upper twelve feet is as steep as gravel will stand. The ridge, on the summit at least, consists generally of fine rounded gravel, with a few rounded boulders. The material is not well assorted, varying from fine rock flour to boulders fifteen inches long. The ridge is wooded with Banksian pine and aspen poplar. As viewed from a distance to the westward, the summit of the ridge does not appear to be either regular or horizontal, dipping to the north as it does to the south.

This ridge taken as a whole, from the mouth of Birch Creek down the Saskatchewan to a mile or two below the Mission, is very similar in character to the ridge between Winnipegosis and Cedar Lakes, dropping abruptly towards the west and declining gently towards the east, the steep side being marked by shore-lines and capped by water deposits. This, then, may be a continuation of the same morainic ridge.*

Above The Pas, the banks of the river are again composed of stratified alluvial deposits to within a short distance of Pine Island Lake where the light-gray till reappears. The shores of this lake appear to be very generally composed of till. A low point touched at on its north shore, consisting of light-gray pebbly boulder-clay, is surrounded by a great number of boulders. These are chiefly of limestone, white, reddish and yellow, and for the most part are well glaciated. Some contain such fossils as *Favosites*, *Stromatopora*, etc., and seemed to have been derived from rocks of Niagara age. On the Sturgeon River, above Pine Island Lake, the banks are composed of till, except where low exposures of limestone show beneath it.

At a prominent point on the east side of Sturgeon Lake a light-gray fine grained limestone outcrops near the edge of the water. Its surface is smoothed and strongly scored with glacial marking trending S. 20° W., crossed by many disruptive gouges opening southwards and showing the direction of glacial motion. No fossils were found in this rock, but the shore is covered with large angular masses of yellow porous dolomite, evidently derived from the immediate vicinity, holding *Receptaculites Oweni*, Hall, *Maclurea Manitobensis*, W., *Strophomena* sp. *Bumastus Trentonensis*, Emmons, *Cheirurus pleurexanthemus*, Green, etc., clearly distinguishing the beds as the equivalents of those at East Selkirk and Lower Fort Garry, or the horizon of the upper part of the Trenton. There were also some boulders of soft yellow sandstone, containing a number of fossils, among which are *Endoceras annulatum*, Hall, *Actinoceras* sp., *Maclurea Manitobensis*, W., and *Conradella* sp.

On the west side of Sturgeon Lake, are many exposures of horizontal thick-bedded white or salmon-coloured fine-grained limestone. One of these outcrops, which was more closely examined, was found to contain many casts of salt crystals and small fossils, among which are the following:—*Leptæna uncostata*, M. & W., *Plectambonites sericea*, Sby., *Dinobolus parvus*, Whitfield, *Metoptoma* sp., *Cyrtodonta Huronensis*, B., or *Canadensis*, B., *Cyrtodonta*? sp., *Trochonema* sp.

* See Report on North-western Manitoba, &c., pp. 54 E–56 E, Annual Report Geol. Surv. Can., Vol. V. (N.S.), 1890-91.

Loxonema sp., *Gyroceras* sp., indicating the horizon of the Trenton, but probably below the last.

The boulders on this shore are chiefly of fine-grained green Huronian rocks, giving evidence of the presence of this formation at no great distance towards the north-north east.

Sturgeon River.

The Sturgeon River, above Sturgeon Lake, is about 200 feet wide, with banks wooded with poplar. In many places the water flows over a bed of flat-lying limestone, while the west and south-west banks often consist of cliffs of this rock. The Red Rock portage, at the mouth of Goose River, is over horizontal white limestone, with a few traces of corals. Its surface is smooth and marked with glacial grooves trending S. 25° W. The river is generally very swift and shallow, from which it derives its common name of Rivière Maligne. In the twenty-five miles between Beaver and Sturgeon lakes there is a fall of about two hundred feet.

Beaver Lake.

Beaver Lake lies along the line of contact of the Archæan and overlying Palæozoic rocks, its west shore being formed of undisturbed horizontal white limestone, often cleanly jointed, while the east shore, and most of the many islands are of Archæan rocks, though the first island visited was of limestone. A small bare island, lying in the course of the canoes, was of thinly foliated wavy micaceous gneiss, striking S. 25° E., and dipping N. 65° E. at an angle of 70°. The surface is strongly glaciated, the glacial grooves all trending S. 20° W.

Northern edge of Palæozoic limestone.

The limestone escarpment follows the west side of the river up to Spruce portage, three miles above Beaver Lake. It is here about fifty feet high, and on its face, twenty feet above the river, is a terrace, apparently representing an old lake shore. The portage itself, on the

Gray gneiss.

east side of the river, is over a coarse red and gray augen-gneiss, very evenly foliated, striking S. 35° E. and dipping N. 55° E., at an angle of 50°. From Spruce portage to Snake portage the banks are rather low, with low bosses of gneiss rising here and there through the loose gray stony soil. For about two miles above the latter portage the river is winding, above which it runs for several miles in a narrow even valley between rocky ridges forty to eighty feet high, that to the south-west being bold and bare, while that to the north-east is more sloping and wooded. The valley runs along the strike of the thinly foliated biotite-gneiss, which in one place was found to dip N. 65° E. at an angle of 60°. The top of the ridge to the east is in the same place marked with glacial groovings trending S. 10° W. As the next portage is approached, where the river falls over a ledge of rather coarse reddish-gray granite, cut by veins of red pegmatite, scarps of

Straight valley.

evenly and horizontally stratified gray sand twenty feet in height form the west bank, and for the next four miles, up to Leaf portage, a sandy terrace from twenty to twenty-five feet in height runs along by the river. The course of the river is now remarkably straight, following the strike of the rock, which at Leaf portage is a well foliated, fine-grained gneiss. The glacial striae here trend S. 15° W. Above Leaf portage the river flows through small irregular lakes, to the south-west of which are high bare hills of light-gray granite.

At Birch portage the rock is a coarse well banded red gneiss, striking S. 30° E. and dipping N. 60° E., at an angle of 40°. The surface is well striated, in the same direction as at Leaf portage. Above Birch portage the river is wide, with an easy current, flowing in a rocky valley with sides densely wooded with poplar. This wide straight stretch of river is separated from Crow Lake by a rapid, which is passed on Dog portage, a short carry over a low rocky island. The rock is a rather fine-grained micaceous gneiss, with large white porphyritic crystals of felspar. It strikes S. 30° E. and dips N. 60° E., at an angle of 20°. The surface is strongly marked by glacial striae trending S. 10° E.

At Crow portage on the opposite side of Crow Lake, the York boat brigade from Reindeer Lake was met on its way to Cumberland, carrying out the winter's trade in furs. Above this point the river breaks into a number of lakes, on one of which, called Pelican Lake, the Hudson's Bay Company has a small trading post. Between the trading post and Beaver Lake, a total distance of sixty-five miles, the river has an estimated fall of ninety feet.

At the short portage above Pelican Lake, the rock is a coarse gray micaceous gneiss, striking S. 35° W., and dipping S. 55° E., at an angle of 70°. Its surfaces show well rounded northern and craggy southern sides. Though much weathered and rather rough, it shows many glacial grooves trending S. 25° W.

A mile and three-quarters to the northward are two portages quite close together, the upper one past a pretty little fall about twelve feet in height, where the water tumbles over a ledge of gray micaceous gneiss. Both around the top and part way down the sides of the rock at the falls, are many pot-holes, from one to two feet in depth, worn out of the solid granite-gneiss by pebbles and boulders kept whirling by a heavy current. The largest pot-hole, which has been considerably deeper than the rest, has much of its northern side now broken away. It is close to the present fall, and about two-thirds of the way down the slope. Many of the pot-holes are clearly preglacial, the glacier having broken their northern and

smoothly rounded their southern edges. The southern edge of the large pot-hole shows this smoothing very clearly. Two sets of striae are here apparent, the first trending S. 15° W. and the second S. 30° W., but it is probable that there is not a great difference in their age. It would appear that a considerable stream, much larger than the present one, had flowed southward over this rocky barrier in preglacial or interglacial times, perhaps carrying the Reindeer River, or part of the Churchill River, the intermediate portion of the channel having since been blocked by till.

Frog portage. At nine o'clock on the evening of July the 10th, the party reached Frog portage, having travelled 180 miles from Cumberland, or 395 miles from the mouth of the Saskatchewan. The portage is about 300 yards long, over two low ridges of gray till studded with boulders of gneiss. To the west of the portage is the channel of the brook, much obstructed by boulders, cut off from the Churchill River, except at high water, by a narrow ridge of light-gray gneiss. The water south of the ridge was ten feet below that in the Churchill River. Opposite the north end of the portage the Churchill River is half a mile wide, with its banks and islands covered with poplar. On the nearest island is an old warehouse of the Hudson's Bay Company, while on a low rocky point just to the west of the portage, formerly stood an old trading house, perhaps the one built by Mr. Joseph Frobisher in 1775, when he first penetrated this then unknown wilderness to barter the products of civilization for the rich furs of the Indians. From him this great stream derived the name of English River.

Churchill River.

Eskers.

From Frog portage our course was down the Churchill River, for about twenty-one miles. The river at the narrower parts has a steady current of from two to three miles an hour. Its banks are composed of gneiss, which is more or less deeply overlain by till, and the hills are well wooded with poplar. Eight miles down the stream several bare sandy hills rise to heights of sixty feet on its northern bank. They are narrow, lenticular ridges of loose sand, with a few boulders lying on their summits. The sides are as steep as the sand will stand, while the ends slope easily down to the general level, the south-western end being steeper than the north-eastern. They trend S. 25° W. in the direction of the glaciation, and are thus typical eskers, the first observed during the course of this season's exploration. From these eskers to the Kettle Falls, ten miles further down the river, there is a well defined sandy terrace on the sides of the valley about twenty feet above the stream, doubtless caused by the damming up of the Churchill River both at the eskers and at the gap below the mouth of Reindeer River. The Reindeer River, and the Churchill River above

it, flow in one continuous valley, which the united waters leave by what appears to be a narrow gap in the hills to the east. At Kettle Falls the Churchill River precipitates itself in a magnificent cascade over a ridge of thinly foliated light greenish-gray gneiss, striking S. 15° E. and with vertical dip, while six miles to the north Reindeer River rushes in the opposite direction over a barrier of coarse light-gray porphyritic gneiss.

Continuous valley.

For the next thirty-two miles up Reindeer River, to Steep-hill Falls and portage, this latter stream fills the bottom of a valley between hills from 200 to 400 feet in height, and has the character of a long narrow lake rather than a river, for only in three or four places could current be detected. On both sides deep bays frequently indent the shore. Some of the hills are rugged and almost bare, though most of them are covered with forests of aspen. The rock is a dark or light gray gneiss, with a generally roughened surface, though here and there a few points are smoothed and show glacial groovings. Below Steep-hill portage the rock is a coarse gray hornblende-gneiss, striking N. 20° E., and dipping N. 70° W., at an angle of 17°. Below Steep-rock Fall there is quite a heavy rapid, and at the fall the water flows in several channels between islands wooded with spruce, tumbling fifteen feet over a band of gneiss. The portage is over a hill rising forty feet above the water at its lower end, composed entirely of light-gray compact clay, apparently without boulders. In the next eighteen miles the river widens into several small lakes, and the banks rise in gentle rocky slopes, the knolls of bare gray gneiss peeping out here and there through the covering of poplar woods. Between the knolls the surface is underlain by light-gray till. Then for seven miles it flows in a regular, well-defined channel, winding through a low bottom-land wooded with small spruce and tamarack, behind which rise the rocky ridges.

Reindeer River.

Wide River.

At the upper end of this well defined channel the water rushes between high, almost vertical, rocky walls, forming what are known as Manitou Rapids, where the canoes ascending are passed with difficulty over a low rocky island in the middle of the stream, and then paddled with all possible speed across the rushing current to an eddy in a bay on the eastern bank, failing to reach which they are sometimes engulfed in the heavy waves below.

Manitou Rapids.

Above Manitou Rapids, the river opens out into a small lake with rocky shores. Passing from the southern to the north-western angle of this lake, a distance of four miles, the stream is again encountered as it descends about sixteen feet in two distinct falls over a rocky ledge

White Sand
portage.

composed of a rather coarse gray hornblende-gneiss striking N. 25° E., and dipping N. 65° W., at a high angle. The portage on the south side is over gneiss and light-gray sandy till with boulders. At the foot of the portage a rounded knoll shows strong glacial groovings trending S. 17° W. On the north side of the falls are cliffs about fifty feet high of orange coloured stratified sand and gravel, showing a section of the south end of an esker which stretches from this point away to the northward as a high wooded sandy ridge, culminating near its northern end in a point probably 150 feet in height. Above White Sand Falls the river opens out into another small lake, on both sides of which are sandy terraces fifteen feet above the water. Above this lakelet is a short stretch of current, at the head of which is a fall of

Rock portage.

eight feet. Canoes reach the quiet water above it by a short portage, across a bare island of similar gray gneiss striking N. 55° E., the surface of which shows distinct glacial groovings trending S. 17° W., as before. This island is known as Rock portage, and the open water to the west of it is the southern end of Reindeer Lake.

Reindeer
Lake.

Above Rock portage the country at once becomes much more barren and rocky. Below it the hills were fairly well covered with till, but now the till seems to have disappeared, and a few pines and spruces cling to the brown lichen-covered rocks. The sandy terrace is, however, still present at about fifteen feet above the water. From a small trading store of the Hudson's Bay Company our course was northward along the eastern side of Reindeer Lake, generally winding among its almost innumerable islands. Du Brochet post, at the northern end of the lake, was reached on the afternoon of the fifth

Rocky shores.

day. The shores throughout are exceedingly rocky and the rock is generally a typical Laurentian orthoclase-gneiss more or less foliated. Till is notably scarce, but the sandy terrace or old lake beach is almost everywhere seen between fifteen and thirty feet above the water. The Hudson's Bay Company's store and the Roman Catholic mission at the north end of the lake are built on this terrace. The glacier of at least the latter part of the glacial epoch followed in a general way the long axis of the lake, as shown by the courses of the glacial striæ, flowing south-westward from its north-western end, and south-by-west towards its southern end. One set of striæ was all that could be found anywhere, and no evidence was found such as to indicate any other direction of glacial motion at any time during the glacial period. The dark lichen-covered hills bear a scattered growth of black spruce, with an occasional stunted canoe birch, on the lower slopes, while a few small Banksian pines and aspen poplars grow on the sandy terraces, almost to the north end of the lake.

Direction of
glaciation.

The distance travelled from Frog portage to Du Brochet post was about 250 miles, and the total distance already travelled in canoes 645 miles, in which distance there are nineteen portages.

COCHRANE RIVER.

Du Brochet trading store and mission are situated on a sandy terrace near the north-eastern extremity of Reindeer Lake, three miles from the mouth of Cochrane River. Many of the islands in the bay to the south, are encompassed by high bouldery beaches, giving evidence of the presence of till, or more probably morainic detritus, in the vicinity. The position of the store was found to be in north latitude $57^{\circ} 53' 16''$, while Mr. Dowling's survey of 1892 places it in east longitude $101^{\circ} 52' 42''$. Variation of the compass in July, 1894, $20^{\circ} 30'$ east.

In ascending Cochrane River, the channel for the first seven miles and a half is very irregular, being often broken by wooded islands. In places it is about a hundred and fifty yards wide, with a current of two or three miles an hour; in other places it is much wider and with very little current, while towards the upper end of the stretch are two heavy rapids up which the canoe must be tracked with a tow-line. The water is clear and cool. The banks are low and grassy, and low, rocky points project into the water here and there. The surrounding country is low and swampy, underlain by sand and sandy till, and is wooded with small black spruce and larch. A low sandy ridge wooded with Banksian pine, extends along the east bank for a short distance. Seven miles and a half from the lake, the river falls about twenty feet over medium-grained gray hornblende-gneiss, the surface of which is indistinctly grooved S. 35° W. These falls are passed by a portage 420 yards long on the east side. The portage is over a drumlin ridge of silt and Laurentian boulders trending about S. 40° W.

Three-quarters of a mile higher up the stream is a heavy rapid with a fall of eight feet, the water flowing over a coarse light-reddish slightly biotitic granite. The surface is strongly glaciated, having been smoothed and grooved, the grooves trending S. 30° W. It is passed by a portage 180 yards long on the west bank, over a neck of land composed largely of boulders. A mile above this portage is a swift rapid a quarter of a mile long, up which the canoes were taken with tow-lines and poles.

Two miles above this rapid the canoe-route for a time leaves the river (which continues on towards the north-east, and is said to be very crooked, with one bad rapid), and crosses through a chain of small

Four
portages.

lakes, connected by four portages. The first portage connects a deep sandy bay on the west side of the river with a small lake of clear brown water a mile wide. It is 600 yards long, and crosses a ridge fifty feet high running S. 35° W. It has a steep slope at its south-western end. On the sides of the ridge are rounded depressions and smaller parallel ridges. These are in places composed exclusively of boulders, and represent an old shore-line twenty feet above the present water-level, or sixty feet above Reindeer Lake. The ridge, which is thinly wooded with Banksian pine, is merely one of a scattered group, some of which appear to be a hundred feet high. They all run in the same direction, parallel to the direction of glaciation, and they probably represent a commingling of glacial and fluvial deposits near the line of a terminal moraine, at the southern end of the esker ridge which extends from here towards the north-east.

Ancient shore.

The second portage is 375 yards long, across a ridge of sand and boulders thirty feet high, between lakes, the northern one of which is ten feet higher than the southern. The former lake, which has low wooded and swampy shores, is nearly a mile in diameter. From its northern end is the third portage, 650 yards long. This portage follows a valley between sandy esker ridges, the southern half being along the western side of one of the ridges, and the northern half in the bottom of the valley. The lake at the northern end, appears to be about five feet higher than that to the south, is a mile and a quarter long and very narrow. At its northern end is the fourth portage, in north latitude 58° 6' 19". It is 400 yards long over a very stony morainic hill, which has a wide sandy plain on its western slope.

Shallow lake.

At the west end of this portage is a shallow lake nearly a mile in length, with sandy shores. From its north-eastern end flows a creek sixteen feet wide, winding for a third of a mile through a sandy plain to the south end of a larger lake. At times paddling and at times walking in the water on the sandy bottom, the canoe was taken down this brook, and across the sandy bar into the outer lake. This lake, which is six miles and a half long, is constricted to quite a narrow channel about the middle. Some of its islands are rocky, one, half a mile north of the narrows, being composed of dark hornblende-gneiss striking N. 30° W., and dipping N. 60° E., at an angle of 30°. Others are drumlins of sand and boulders. One of these, near the north end, rises as a bare unwooded island to a height of sixty feet above the water.

Canoe-route
returns to
river.

The north end of the last lake opens by a wide channel into Cochrane River, up which the canoes were again directed. On the

west bank a sandy terrace rises just behind the beach to a height of twenty-five feet. Half a mile further west is a high sandy ridge. For the next thirteen miles the river flows on a very direct course from north 28° east. The current is nowhere very strong, and in the wider places is hardly apparent. The banks are either low or rise in sandy ridges. Not many exposures of the underlying gneiss were to be seen. At the camp of the evening of July 22nd, where the east bank was more particularly examined, the flats were wooded with Banksian pine, behind which was a ridge of boulders twenty feet above the water, representing the boulder-pavement of an old beach. Half a mile to the east was a ridge, 150 feet high, and parallel to the river, composed of sandy rock-flour and boulders of Laurentian granite, gneiss and mica-schist. The ridge appeared to be composed entirely of unassorted detritus, and both it and many of the adjoining ridges may be classed as ispatinows deposited by the glacier on an uneven rocky floor, the positions of the ispatinows being determined by the existence of high rocky prominences, and their direction by the flow of the ice. The general character of these ispatinows, and the presence of a large amount of glacial detritus in this vicinity, and its absence from such considerable areas as that around Reindeer Lake, will be considered in a later chapter. The ridge is wooded with small Banksian pines, while the low land is covered with black spruce and birch.

At the north end of this straight reach of river, the boulder-pavement is particularly well shown, fifteen feet above the water. Near by is a rounded boss of a granular reddish, slightly biotitic granite, with dark schistose inclusions. The surface is well smoothed and shows strong glacial grooves trending S. 30° W.

Here, in north latitude $58^{\circ} 22' 45''$, the river leaves its well defined channel, and comes from the north-west, where it flows through a number of larger and smaller lakes. At the first narrows between these lakes there is a stiff current, and to the west is a high ridge of sandy esker-like hills. Other high bare hills of sand and boulders rise on every hand, and the country looks very desolate and barren. A few outcrops of the underlying rocks enable one to keep track of their character. One of these outcrops is on a small island three miles and a half from the last-named narrows, and consists of dark hornblende gneiss striking N. 60° E., and dipping S. 30° E., at an angle of 60° . Its surface is distinctly marked with glacial grooves trending S. 13° W. A few miles further north, in latitude $58^{\circ} 31'$, a high hill of gneiss rises from the west bank, being the first conspicuous rocky hill seen in the ascent of this river.

Route to
Island Lake.

Towards the north-east, a small river was said by the Indians to empty into the bottom of the deep bay that extends in that direction. Up this stream is a practicable canoe-route across a height-of-land through many small low-lying lakes connected by swampy portages to Nuelin or Island Lake, and thence down Thlewiaza River to Hudson Bay.

North of the rocky hill the river contracts, and then widens again to a small lake, from the north-west angle of which is a portage 800 yards long, through a swamp and over a low ridge of clay and boulders. West of this portage is a long narrow lake which the canoes cross for two miles in a south-westerly direction, to a swift deep narrow creek 15 feet wide and 200 yards long, with a fall of 6 feet from the next lake above. Its banks are of boulders. Five miles and a quarter above this creek, through a curving lake and past a heavy rapid with a fall of eight feet, the next portage is reached. It is 1300 yards long and rises at its southern end to the top of a dry sandy plain thirty feet above the river. It keeps on this plain through most of its length, a sandy ridge twenty feet higher extending along to the north-east of it. Close to its north-western end the ground becomes rougher, and a few boulders are scattered through the sand. The total rise from one end to the other is about ten feet.

Du Brochet
Lake.

The upper end of the portage is on the shore of Du Brochet or Pike Lake, the largest lake on Cochrane River between Wollaston and Reindeer lakes. Its altitude is about 1230 feet above sea-level. The lake appears to be shallow, with low shores of sand and boulders. To the south are some rather high hills, and to the north the country is low, swampy and wooded with black spruce, the low hills here and there being composed of gneiss. The general direction of the glacial striae is about S.W. by S. The whole body of water known as Du Brochet Lake, which the canoe-route traverses for thirty-eight miles, is divided into three parts by two short reaches of stream, the first with an easy current, and the second, seven miles from the west end, is a heavy rapid with a drop of about eight feet. This latter was ascended with tow-lines. At the west end of the lake is a portage 300 yards long over a low swampy island covered with yellow cloud-berries (*Rubus chamaemorus*). In high water this portage is not used, for the canoes can ascend the channel of the river to the south of it.

Above this portage a small double lake, with rocky shores, extends for six miles, beyond which the river flows for two miles, with a strong current, between wooded sandy banks, to a narrow gap, where it cuts through an esker of stratified sand and gravel, extending as a

long even ridge away to the south. A mile and a quarter above the gap in this ridge, a small tributary joins the river from the south, up which is the canoe-route to Wollaston Lake followed by the late Mr. A. S. Cochrane in 1881. Above the mouth of this brook, Cochrane River flows with a rapid current, over a bed of sand and boulders in a moderately straight channel down the west side of the esker. At a point on its east bank some old tent-poles showed us that here was a regular Indian camping place. The river still keeps its course from the north, but the canoe-route to White Partridge Lake leaves it here and crosses the sandy esker ridge by a portage 600 yards long.

The following description of the upper part of the route from Reindeer Lake to Wollaston Lake is extracted from Mr. Cochrane's manuscript notes taken in July, 1881. It starts from the mouth of the brook mentioned above:—

"Leaving Hatchet Lake, we went up a very small and crooked river—the outlet of all the small lakes to be passed through. In it are two rapids, past the lower of which there is a portage at low water. The first lake reached I have called Spider Lake, from its many long arms and comparatively small body; the second Wolf Lake, from seeing a large white wolf watching us unloading the canoes, from a small hillock not far off. The next lake is reached by a very small, short and shallow stream, which flows from it, and a portage of say twenty yards. The next two lakes remain unnamed, and between them is a portage of 400 yards [the latter being again on Cochrane River about fourteen miles by the course followed from where it had been left at the mouth of the rivulet.] The country passed through has been swampy and very flat indeed, though occasionally high hills were seen in the distance. The land, as usual, has been sand and boulders; the timber stunted." In ascending Cochrane River, which has now turned and is flowing north-eastward, two miles are spoken of as a "very bad bit of river, with six rapids and two portages." The first portage is at the third rapid and is 300 yards long, and the second portage is at the fifth rapid and is 250 yards long. Both are on the south-east side. These rapids all occur where the river passes through a low range of hills, between sixty and eighty feet high, "of coarse, brown thinly foliated gneiss striking N. 15° E., and dipping S. 75° E., at an angle of 45°." "The hills here divide and run along on either side of the river. They are not burnt, but are covered with a sickly growth of small Banksian pine, spruce and birch."

Mr. Cochrane's description of the upper part of the river.

Five miles above the upper end of these rapids, Drifting Lake was entered, and a mile farther south "the rock suddenly ends, and the

Drifting Lake.

islands and points passed are composed of sand and gravel, with some boulders." Gray gneiss was seen outcropping at the water's edge in one or two places on this lake. The river, which enters Drifting Lake at some low country on its north-west side, is followed by the canoe-route for nine miles, past the mouth of Sunshadow River, flowing from Sunshadow Lake, seven or eight miles to the north. The canoe-route leaves the river on the west side of a small sheet of water known as Big-stone Sitting Lake, half a mile south of where Cochrane River enters it, and passing over three portages, respectively 400, 240, and 415 yards in length, reaches a deep bay in the north shore of Wollaston Lake, avoiding what was stated to be a long and rapid piece of river. In this northern arm of the lake the underlying rock is seen in very few places, "the points and islands being all either sand and fine gravel, or boulders and sand, all very low. The hills, also, bordering the shore-line, are all low."

Esker east of
the river.

Let us now return to the portage on the route to White Partridge Lake. As stated above, the portage is 600 yards long over the sandy esker, which is here seventy feet high. At both ends are steep slopes, the eastern one leading down to the shore of a long narrow lakelet about fifteen feet above the river. The esker in general character is a regular, well-defined long sandy ridge, but in detail it here rises in many little knolls and ridges, sinks into deep depressions and spreads out into sandy plains wooded with an open growth of large Banksian pine. On the portage itself is a grove of fine tall white spruce, the best trees seen on the banks of Cochrane River, and here the Indians seem to resort regularly to obtain wood for their canoes, while birch bark can be procured from trees on the same sandy ridge a short distance farther north. The narrow lake now reached runs northward for three miles and a half, with the sandy ridge, wooded with large white spruce and birch, on its western side, and a ridge of gneiss to the east. At the north end of this lake a portage 200 yards long leads over a sandy ridge to another small lake similarly situated to the last. Thence, extending in a direction N. 28° E., is a chain of five small lakes at about the same altitude, with sandy shores thirty to seventy feet high, thinly wooded with spruce, larch and Banksian pine. Towards the north some of the ridges contain a great many cobbles and rounded boulders, but no outcrops of the underlying rocks were to be seen. The lakes are, respectively, one, two-thirds, one and three-quarters, four, and two and a quarter miles long, and are connected by portages 20, 40, 800 and 1000 yards long, the longer ones being over sandy plains, with steep slopes forty feet high at each end. These portages and small lakes are on the height-of-land between Cochrane and

Chain of
portages.

Thlewiaza rivers, at an approximate elevation of 1425 feet above the sea. West of the forty-yard portage is the northern bend of Cochrane River, above which the river comes from the south-west.

THLEWIAZA RIVER.

From the north end of the last of the above described lakes, a portage 700 yards long leads over bare rugged morainic hills of rounded cobbles and boulders to the southern end of a narrow lake, whose shores here rise steeply to the height of 70 feet, the hillsides being wooded with large white spruce up to seventy-six inches in circumference, three feet above the ground. The lake is 45 feet below the one just left less than half a mile to the south, and its sides are springy and wet. The water looks dark and blue in the bottom of the deep cirque-like depression, from which the Indians give it the name of "Blue Lake." The upper part of Cochrane River would doubtless drain towards the north-east down this or some adjoining valley, if the water were not dammed back, and directed to the south by the large moraine just crossed.

Blue Lake.

Obstructed drainage.

Blue Lake is a beautiful narrow lane of quiet water a mile and a half long, the eastern side of which is low, with a high ridge of boulders in the background, while on its western side is an even sandy esker thirty feet high, the face of which is wooded with white and black spruce, birch, alder, willow, and straight aspens four inches in diameter, the first of these latter trees seen for a long time. This lake is one of the principal fishing places resorted to by the Indians at some seasons of the year.

Deciduous woods.

Near its northern end, a portage 200 yards long crosses the esker to another small lake, rather over a mile long, beyond which is a portage twenty yards long, with a drop of eight feet, to the south end of Thanout or Gravel-ridge Lake. This is a narrow river-like stretch of water thirteen miles and a half long, and varying in width from 300 yards to a mile, extending almost straight N.E. by N. Near its south-western extremity it is said to receive a tributary from Trout Lake. The water is clear and cool. The shores are generally composed of low hills of sand and boulders, and terraces of stratified sand. At a narrows with current, six miles down the lake, is a small island of a whitish granular granite, with plagioclase and large crystals of biotite, and showing a slight gneissic foliation N. 40° E. Two miles further north the west shore is composed of an almost vertical well foliated gray gneiss, with an easterly strike. To the north rises a conspicuous rounded hill 125 feet high, of a coarse white granite con-

Thanout Lake.

Red Head's
house.

taining a small quantity of biotite, while a mile to the north-east is a high island of similar granite. In many places the beach is a rough wall of large boulders, while here and there are a few sandy bays. A mile above the north end of the lake, Red Head, the chief of the band of Chippewyan Indians trading at Reindeer Lake, has a comfortable little house where he spends the winter.

Deep wooded
gorge.

From the north end of Thanout Lake, a stream twenty-five yards wide and moderately deep, flows with a stiff current between low sandy wooded banks. It soon widens and loses its rapid current. Rocky and sandy hills are to be seen on each side. Three miles and a half below the lake, the river plunges over a steep slope and disappears in a deep wooded valley extending towards the north. To avoid this gorge a portage was made over some rough stones for twenty yards, to a pond 200 yards wide, beyond which everything was carried across a portage 1800 yards long, in which there is a drop from one end to the other of seventy feet. For 1100 yards this portage is along a sandy or gravelly ridge, at a constant elevation, to the face of a steep escarpment; while the remaining part, 700 yards long, is over a low flat composed of broken angular masses of rock with little or no finer infilling. Walking with a heavy load on one's back over these large rough stones was very difficult and unsteady work. The portage ends on a swampy slope at the foot of the heavy rapids, and below it the river flows for two miles and a half, with a swift current, between stony ridges to the south end of Theitaga or Sandy Lake, in one place rushing over a band of schistose gneiss with a northerly strike.

Theitaga
Lake.

Lower course
of Thlewiaza
River.

Theitaga Lake itself, through which the canoe-route to the north passes for fourteen miles, is an irregular sheet of clear water. Its shores and islands are composed of boulders and silt, often in elongated hills or rounded drumlins, among which are scattered a few hills of sand. A point near the middle of its west shore was found to be in north latitude $59^{\circ} 35' 43''$, with a magnetic variation of 21° east. The lake has an elevation of about 1200 feet above the sea, and is said to discharge by a stream which flows into the west side of Nū-el-tin or Island Lake, a short distance north of where Denéchethé, a Chippewyan, one of the sub-chiefs of the band that trade at Reindeer Lake, has a house which he occupies in winter. Nū-el-tin Lake is said to be long, narrow and dotted with many islands. Its southern end lies within the woods, while its northern end stretches into the Barren Lands. From this end the Thlewiaza or Little-fish River flows down some heavy rapids to Thétinné, or Seal-hole Lake, beyond which it flows over other rapids to Edehon or Horn

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GEOLOGICAL SURVEY OF CANADA.



J. B. TYRRELL.—Photo. July 31, 1894.

NEAR THE SOURCE OF THLEWIAZA RIVER.

Narrow channel with even walls of boulders.

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Lake. Below Edehon Lake it is said to flow with an easy current and to empty into Hudson Bay a day's journey north of Egg Island, or two days' journey south of Cape Esquimaux.

From the north end of Theitaga Lake, the canoe route to Kazan River ascends a small stream, here called Thebayazie River, from the name of one of the Chippewyans who accompanied us. It is about fifty yards wide, with a fairly strong current, flowing over a bed of angular masses of gneiss. Half a mile above its mouth is a rapid, where the water falls over a ledge of light-gray gneiss striking N. 60° E. and dipping S. 30° E., at an angle of 30°. The canoes were carried past this rapid, on the east bank, over a portage 300 yards long. The track is a bad one, over rough, irregular masses of rock, and it was with difficulty that a spot could be found anywhere in the vicinity sufficiently level to sleep on. A flock of the beautiful Bohemian waxwing (*Ampelis garrulus*), was seen in a grove of small birches beside the rapid. As it was the 30th of July the birds were doubtless on their breeding ground, of which so little is known in North America. Unfortunately, time and the long journey still ahead of us did not allow us to search for the nests and eggs.

For fifteen miles, Thebayazie River comes through a chain of small lakes connected by rapids, where the river generally flows over a bed of boulders and between banks of boulders. The shoving of the heavy ice in spring has packed the boulders down to an even pavement, and shoved the sides back into even walls, giving the channel the appearance of a regularly built chute of dry masonry. Up some of these rapids the canoes could be towed with a line, or hauled by hand while walking in the water, but in the latter case the bed of boulders gave a difficult and uncertain foothold. Past others it was necessary to carry everything over the rough stony flats or ridges of boulders.

The portages are as follows:—575 yards on the east side, 700 yards between the ends of two lakes in north latitude 59° 45' 54", 525 yards between two lakes, and 180 yards on the west bank. The surrounding country is low and swampy, but low ridges of boulders rise here and there, and one sandy hill stands on the east bank about a mile and a half above the mouth of the river.

Above the uppermost of these small lakes, the river flows for two miles and a half in a winding channel, for the first mile between low marshy banks, and then through a plain of stratified sand, to the foot of a heavy rapid over boulders, past which is a portage, on the west bank, of 500 yards, along the side of an almost bare lichen-covered hill of till and boulders. Just above the head of the portage is a hill

Hills of
granite.

of a rather coarse red biotite-granite, much jointed, and breaking into angular fragments, especially on its southern, but also on its northern side. Its surface is well polished in places. Coarse glacial grooves are entirely absent, but on the polished surfaces scratches and fine grooves can generally be detected, all trending S. 18° W. A mile and a quarter higher up the stream a hill of similar granite rises on the east bank. These were the first rock exposures seen since leaving the rapid at the mouth of the river. Three miles farther up the rapid crooked river, is a portage 240 yards long on the west side, and a mile farther is another portage 60 yards long, also on the west bank. Across a shallow lake a mile and a third in length, is a portage on the east bank, 475 yards long, over a low flat mossy swamp. A mile farther, across a similar shallow lake, is another portage 550 yards long on the west bank over an almost bare ridge of very bouldery whitish till. Seen from here the country appears generally low, flat and wooded with small black spruce, while ten miles away towards the north-northwest, half way between this point and Kasba Lake, Roosevelt Hill rises as a conspicuous landmark high above the surrounding plains.

Grassy
portage.

A quarter of a mile to the north, across a small shallow pond, is Grassy portage, 1600 yards long, on the west side of the river, 1100 yards being across a marshy meadow, and 500 yards along a low sandy ridge to the head of the rapid, down which the river flows over angular masses of rock with a total fall of twenty feet. Three quarters of a mile higher up stream another portage of 125 yards on the same side runs across a grassy flat to the mouth of a small stream coming from the south-west, and carrying about half the water of the main stream. A quarter of a mile higher up stream, at a portage 50 yards long on the east bank, the latitude was found to be $59^{\circ} 58' 38''$, and the magnetic variation 23° east.

Drumlins.

Half a mile up stream is another portage, 1750 yards long, on the east side. The portage is a good one, over gentle hills of sand and gravel. Here and there little hills of boulders rise abruptly above the general level. To the east are many drumlins or rounded hills and ridges of boulders trending southward. The portage passes a series of shallow rapids in the river, in one of which is an outcrop of a reddish-weathering biotite-gneiss, well laminated and lying horizontally. It has easily rounded contours, but is generally rough, with a few small polished surfaces, especially on northern angles, though no striae could be seen. On the west side of the river is a long straight esker trending S. 2° E., and from fifty to seventy

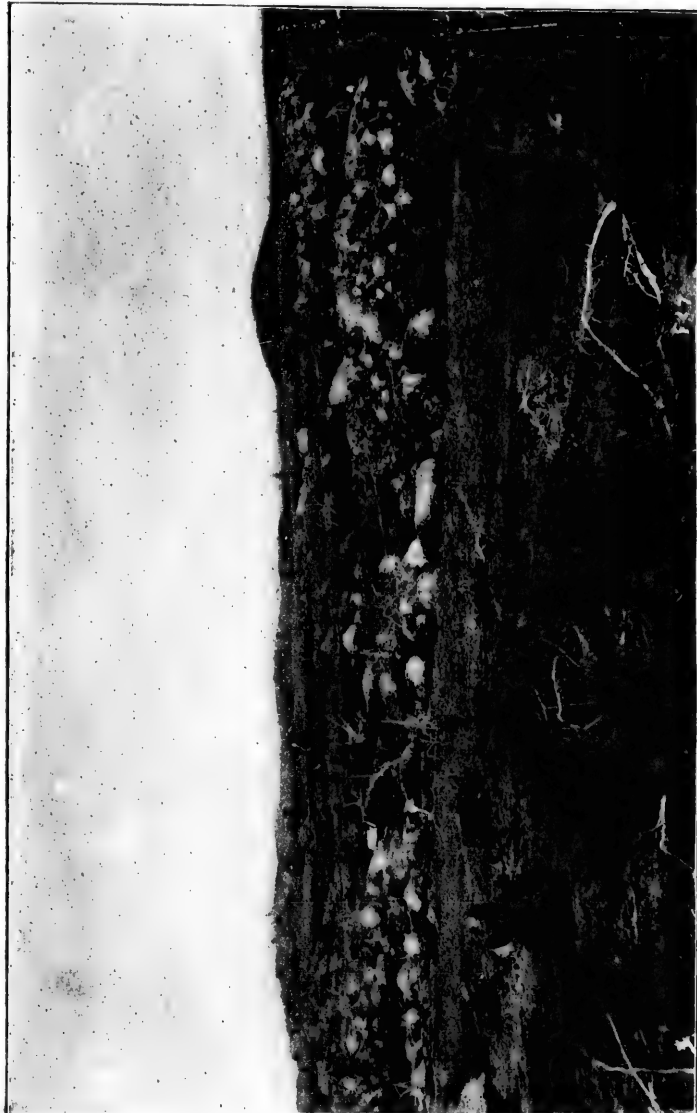
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GEOLOGICAL SURVEY OF CANADA.



J. B. TYRELL.—Photo. Aug. 2nd, 1894.
MORAINIC RIDGE, NEAR THE SOURCE OF THLEWIAZA RIVER.

feet in height. Its surface is composed entirely of sand and gravel. Esker. Its crest is narrow, and its sides slope at angles of 32° to 35° . On its west side is a lower ridge, joining the higher one at its southern end, and making an inclosed hollow between them. A few small stunted aspens were growing near the foot of its western slope, marking the northern limit of the tree in this longitude, as far as observed. Northern limit of aspen.

A quarter of a mile above the head of this portage, another portage on the east bank, 180 yards long, leads over a hill of very much broken gneiss; and half a mile above, a portage 600 yards long, on the left bank, leads over a spur of the esker above mentioned to a wet stony spot beside the stream. At the foot of this portage is an outcrop of similar gray biotite-gneiss almost horizontal, or with a light dip towards the south. It is very much fractured and broken along jointage planes, so that in most places it looks more like a bed of boulders than rock in place. Here and there its surface is smooth and polished, but no striae could be detected.

A mile and a quarter up the brook is a portage 500 yards long on the west bank. It is a rather bad one, on a gentle slope underlain by boulders, and through spruce and tamarack swamp. The tops of the surrounding hills are now for the most part bare of trees. A quarter of a mile beyond a small lakelet is another portage on the same bank, 475 yards long, through swamp at both ends, and for the rest along a bouldery hill side. Again, after crossing a small lake a mile wide, there is another portage of this chain, 500 yards in length, along a very stony and almost open hill. Up to this point the boulders seen were of Laurentian granite and gneiss, but on this hill there are also some of gray quartzitic sandstone and altered conglomerate, probably of Huronian age. Huronian boulders.

A mile and a quarter higher up stream, beyond another small lake, is a portage 250 yards long over low stony ground. Half a mile beyond is a portage 300 yards long over a ridge of boulders, and nearly half a mile farther is another 150 yards long, across a broken ridge of very coarse red granite containing well formed crystals of orthoclase with biotite and rounded crystals of translucent quartz. A mile in the canoe, on a crooked lake, leads to a portage 500 yards long beside a shallow dry valley to the shore of Roosevelt Lake. A quarter of a mile east of the portage, Roosevelt Hill (so named by Mr. Munro-Ferguson after Mr. Theodore Roosevelt, of New York) rises with steep sides to a height of 200 feet above the lake of the same name, or 1650 feet above the sea, and is the highest point in the vicinity. It is composed of coarse or medium grained red biotite-granite, quite massive but cut by vertical joints. The hill is in the form of a short Roosevelt Hill.

ridge extending north-and-south, more rounded on its northern than on its southern side. From its summit an extensive view can be had of the surrounding country. Roosevelt Lake, dotted with thinly wooded islands, stretches out to the west, beyond which Kasba or White Partridge Lake can be seen as a shining white line in the distance, while in other directions lines of water may be seen to extend through the now almost treeless country.

Roosevelt
Lake.

For about three miles the canoes crossed Roosevelt Lake, winding among its rough stony islands, which are wooded with small black spruce. The boulders of which they are composed are almost entirely of coarse red granite. At the bottom of a narrow bay a small brook flows among the stones into the lake, and to the east of it is a portage 400 yards long over rough boulders and boggy ground. At most of the portages on this route the landing places for the canoes are very bad, being on rough beaches of irregular angular boulders, which, when the wind is blowing and the water is at all rough, furnish very uncertain footing for the men, and may scratch or break the canoes.

Beyond a little lake a third of a mile long, a portage of 400 yards long leads over a stony hill. At the edge of the water is a low gently rounding outcrop of red biotite-granite. Its surface is usually rather rough, but some parts are smooth, and show on northerly slopes distinct glacial striae and groovings trending S. 28° W. On smoothed points the surface is very much broken by minute cross fractures, which doubtless assist greatly in the rapid disintegration of the rock under the influence of the weather. A narrow lake extends for a mile and a quarter, and beyond it is a bad portage, 1000 yards long, over rough angular boulders among small black spruce. The two small lakes next on the route are separated by a rough stony ridge, over which is a portage 300 yards long, with a descent to the north of twenty-five feet. In the middle of the second lake is a little meadow, across which the loaded canoes were dragged by hand, while beyond it is a portage 1400 yards long. This portage is over rough hills of boulders, strewn and bristling with small dead spruce, the drop from its southern to its northern end being about forty feet. The boulders are chiefly of coarse red granite, but many, about a twentieth of all, are of Huronian (?) conglomerate or greenish-gray sandstone. Beyond this portage are three very small lakes separated by two portages respectively 160 and 180 yards in length, the first over a low sand-ridge and through a swamp, and the second over rounded boulders. Below these lakes is a portage 800 yards long, over rough hills and ridges of boulders, many of which are of greenish-gray quartzitic sandstone and conglomerate.

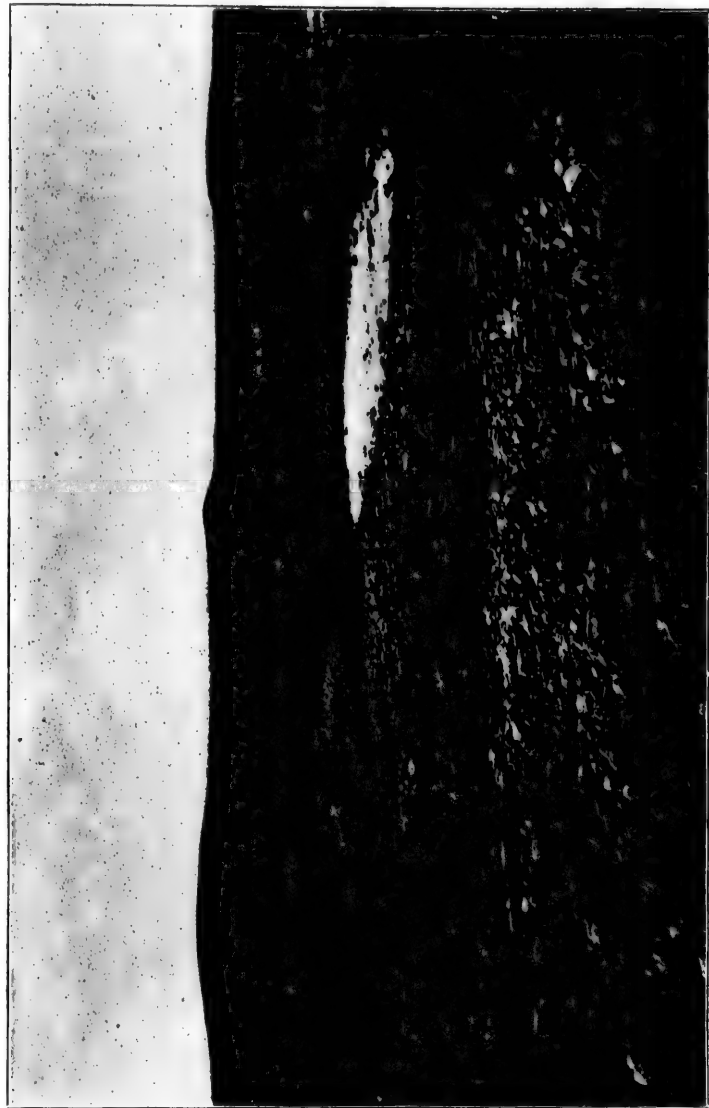
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GEOLOGICAL SURVEY OF CANADA.



J. B. TYRRELL.—Photo. Aug. 3, 1894.

SHATTERED SURFACE OF GNEISS, THE MASSES BEING ESSENTIALLY IN PLACE.
Near the source of Thlewiazia River.

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erate, in a matrix of sand and gravel. The lake at its western end has a considerable extent from north to south, but on the course followed, from east to west, it had a width of a mile, to where a brook flows westward from it down a swift rapid in a very stony channel. A portage 80 yards long was made over the stony flat on the north side of this brook. Below the portage is a small lake, a third of a mile long, from which flows a stream forty feet wide. We descended this stream for 200 yards, to the head of a portage on the north bank, below which the brook flows for a few yards to the brink of a long steep slope, down which it rushes over a bed of cobbles and boulders to the east shore of Kasba Lake, descending 110 feet in this the last mile of its course. Beside it are scarped banks of sand and coarse gravel. About half of the pebbles and boulders are of granite, while the other half are of coarse green conglomerate, sandstone, schist, etc. The portage, which is 1700 yards long, begins on the north bank of the river on a sandy terrace 120 feet above Kasba Lake, and follows the bank of the river for a short distance to a bend, where a fine view is had of the lake beneath. It then turns north-westward along an old gravel beach 140 feet above the lake, which it follows for several hundred yards, when it again turns and descends a long thinly wooded slope to a sandy bay on the lake shore. The lake was reached, in north latitude $60^{\circ} 10'$, on the evening of the 5th of August.

Portage to
Kasba Lake.

KASBA LAKE.

Kasba (White Partridge or Ptarmigan) Lake, the large reservoir near the source of Kazan River, lies at an approximate elevation of 1270 feet above sea-level, as determined by aneroid readings taken on the lake, compared with readings of a standard barometer at Churchill, and estimates of the rise and fall of the land on the route from Reindeer Lake. It has a length, in a north-northwesterly direction of about fifty miles, and a greatest width of about ten or fifteen miles. It is narrow in the middle, and along its sides are arranged a few stony islands, but otherwise the lake is an open stretch of water. The temperature of the water in the open lake on the 8th August was 46° F. It is said to receive several small tributary streams; among these are the Hasbala River on the south, up which is a canoe-route through Hasbala Lake, and then by a long chain of small lakes and portages to Sunshadow Lake, and thence to Cochrane River, a few miles below Wollaston Lake; Klokul River from the west, flowing from Klokul (or Fish-passing) Lake, and Thelwel or Snow-bird Lake, by which there is a canoe-route across to Daly Lake.

Extent and
position.

Tributaries.

High granite hill.

Old beaches.

Berries.

Survey of Kasba Lake.

No rock in place.

South-east of the point where we reached the shore of the lake, a conspicuous rounded hill rises to a height of 430 feet above the level of the water. On its sides are two very distinct ancient gravel beaches, one 50 and the other 120 feet above the lake, while there is a third, but less distinct sandy beach, at a height of 200 above the lake. Up to this latter height the hill is largely covered with boulders and stratified sand, but here, on the north side, is an outcrop of granite. The surface inclines gently towards the north-northwest, and is scored by glacial markings trending S. 30° W. The hill, which raises its bald summit high above the surrounding country, is composed of a red moderately even-grained granite, consisting of orthoclase and quartz with a little biotite, cut by horizontal and vertical jointage planes. The surface, on the summit and northern slope, is well smoothed and often polished, but with the exception of those mentioned above, no striae could be found. The south sides of the little rocky bosses are rough, and the south side of the hill is rugged and often precipitous. The summit and sides are strewn with boulders, chiefly of green conglomerate, quartzite, and other Huronian rocks. Cranberries, blueberries, crowberries and willow berries (*Vaccinium vitis Idaea* and *uliginosum*, *Empetrum nigrum* and *Arctostaphylos arctica*) were found in abundance. A magnificent view is had from the summit of this hill. To the south-east are many shining lakelets, and gentle green slopes thinly wooded with dark spruce. To the north and north-east long lanes of water run between the wooded ridges, while a high sandy terrace marks an old shore-line of the lake. To the west Kasba Lake extends as a beautiful sheet of open water to the blue hills on its further shore.

The line of survey followed the eastern side of this lake, from the foot of the long portage to the point where the lake pours its waters down the Kazan River, a distance of thirty-four miles, measured from point to point. For twenty-nine miles, the course was north-northwestward along an irregular shore. In the bottom of its secluded bays are gently sloping sandy beaches, while its salient points and adjoining islands, are piled round with irregular walls of boulders, often from ten to fifteen feet high. Many of these boulders appear to be of Huronian schists, quartzites, etc. No rock was seen in place, but the boulders are mostly rough and angular, and in some of the islands, at least, appear to be very close to the parent rock. They are evidently thrown and beaten into their present positions by the broken ice in the early summer. Behind the beach the country is thinly wooded in its southern part, while farther north it rises gently in green grassy slopes to hills, some of which are several hundred feet in

height. At the end of the above distance, and where the shore changes its direction towards the north-north-east, an esker crosses the country, forming a chain of sandy islands across the lake and rising in hills on its eastern side. These hills form a long ridge, or chain of narrow parallel ridges, some of which are 180 feet high, running N. 40° E. They are composed of sand and gravel, with narrow knife-edge crests, and sides as steep as the sand will stand. Their summits are almost bare, while on their sides and in the pit-like depressions between them, are some spruce and larch trees of moderate size.

In the bay at the head of the river, is a small island of bare rock, with a very irregular broken surface, composed of a white or light-gray rather coarse crystalline limestone, associated with large veins or masses of white quartz. This limestone is probably of Huronian age, being almost undoubtedly associated with the quartzite and green schists mentioned above.

KAZAN RIVER.

Kazan River flows from Kasba Lake with a slight current, over a bed of boulders, and then, for three-quarters of a mile, rests in a quiet lakelet. Below this it forms up in a well-defined channel, which varies in width from 100 to 300 yards, and rushes down a series of swift crooked rapids. These continue for a mile and three-quarters, to the head of a cascade with a descent of fifteen feet. The cascade occurs over a morainic ridge of boulders, and the channel is deep and narrow at the top, but spreads out over the boulders at the bottom. Past this rapid the canoes and cargo were carried for 300 yards, on the north-west bank, over the top of a rough stony hill.

Below the rapid, the river continues swift, in a shallow but well defined winding channel, with wooded banks of sand or boulders. No rock in place was seen. The surrounding country is moderately level, and declines in a long even slope north-eastward from the vicinity of Kasba Lake, which seems to be held up by an accumulation of morainic material. Towards the bottom of the slope, the river passes through a small lake about three miles long and a mile wide, into the south end of which Chawatili River is said to flow. The lake is surrounded by low hills and banks of sand. Two miles farther down the river, and about ten feet lower in altitude, is a rather larger body of water, called in the Chippewyan language Tabané Lake, with very irregular shores, low wooded points and islands, and a high wooded ridge, perhaps of a morainic character, along its eastern shore. The northern outlet of this lake was found to be in latitude 60° 39' 07".

For three miles farther the river continues as a very rapid stream between steep stony banks, until the bottom of the slope is reached at the south end of the long narrow arm of Ennadai Lake. The descent from Kasba Lake, a distance of sixteen miles in a straight line, is about 170 feet.

Ennadai Lake.

Position and extent.

Ennadai Lake is a long narrow sheet of clear water, lying in a north-easterly and south-westerly direction, and at an elevation of about 1100 feet above sea-level. Its greatest length in a straight line from end to end is fifty miles, and its greatest breadth seven or eight miles. At its southern arm, near where the river enters it, a low ridge of boulders runs along its eastern shore, while an even sandy esker, a hundred feet in height, forms its western shore. This esker runs out into the lake in a long bare sandy point, about four miles from the mouth of the river, beyond which are some sandy islands in the same line. A mile south of the point is a sandy bay where the Chippewyans come in the autumn to spear the caribou as they cross this narrow part of the lake. To the west of the bay, the esker, which is here lumpy and rather irregular, rises to a height of from 200 to 300 feet. It is composed of white silt, sand and rounded pebbles, many of the latter being of green Huronian schist or red quartz-porphry and red Athabasca sandstone. The lower and more sandy hills are thinly wooded with larger white spruce, and some small canoe-birch. The view from the top of these hills shows the open lake, almost without islands, stretching away to the north-east, while all around are gently sloping, thinly wooded hills.

Forest disappears

From the sandy point the lake runs E. N. E., with moderately even shores, behind which are low gently sloping green hills of sand or till. At the south end the hills are usually wooded, but within a few miles the forest disappears, or becomes confined to the ravines, and the hill-sides are grassy or bare. The islands near the south-east shore of the lake, up to the first narrows, are low bare piles of boulders or drumlinoid ridges of till surrounded by walls of boulders. Many of the boulders are quite angular, and have evidently been derived from the immediate vicinity. The first island, two miles and a half from the point, is composed of large masses of dark green Huronian schist, almost in place; while the boulders around others are of granite, green schist, coarse gray diorite, and white crystalline dolomitic limestone. North of the first narrows are several small islands, along the shore of the largest of which, cliffs of peat rise from the water's edge. North of this large island the lake opens out to its greatest width, and some

Cliffs of peat.

high hills rise both on its eastern and on its northern shores. A prominent point on its north-western side is composed of till and angular masses of light-green diabase.

At the north side of this expansion of the lake, on a little peninsula on the west shore, is an exposure of a green chloritic schist, striking N. 35° E., and dipping N. 55° W., at an angle of 80°, cut by some irregular veins of opaque white quartz. It was also seen from the canoe to be cut by a wide dyke of green trap, having a north-westerly trend. The surface is well rounded and smoothed, but no striae or grooves could be detected, although the northern sides are the smooth and gently sloping ones, while the southern sides are steeper and more irregular. With the exception of the small island of crystalline limestone near the outlet of Kasba Lake, this is the only exposure of the underlying rock seen along the canoe-route after leaving the hill near the south end of that lake. The depressions, now filled by at least portions of both these lakes, appear to be along bands of Huronian schists, which have been more easily eroded than the surrounding granites, or than the Huronian conglomerates and quartzites, boulders of which are so numerous near the north end of Kasba Lake, and which may compose some of the hills on the east side of that lake. A short distance north of this outcrop of chloritic schist, the lake becomes very narrow, contracting to about three-quarters of a mile, while high barren hills of till and boulders rise on each side. Farther north, on the east side, the shore is composed of a ridge of green Huronian schist striking N.N.E., and dipping W.N.W., at an angle of 60°, a mile north of which is a prominent hill, 200 feet high, of bright red granite, similar to that on Kasba Lake. Two miles farther north, the party was detained in camp from the 11th till the 14th of August by a heavy storm with rain and snow. The camp was pitched on a sloping hillside, where a little rill, trickling through the stones, nourishes on the wet ground a small grove of dwarf black spruce and larch. The surrounding country is quite barren. The beach is a wall of heavy boulders, while behind the camp a hill rises 280 feet above the lake. This hill is composed of red granite, which in places shows traces of gneissic structure, striking northward and dipping westward at a high angle. Its summit is well smoothed and polished, and in places shows distinct glacial groovings trending S. 40° W. Here the first ptarmigan and the first arctic hares of the season were seen. An observation made the magnetic variation 26° east.

Three miles to the north-west, on the opposite side of the lake, a low ridge of gray gneiss crops out through the surrounding prairie, striking N. 20° E., and dipping N. 70° W., at an angle of 55°, associated

Chloritic schist.

Hill of schist and granite.

with which is a band of dark fine-grained mica-schist, with the same dip and strike.

Barren-ground caribou.

Here, on August 14th, 1894, the barren-ground caribou (*Rangifer Groenlandicus*) were met for the first time that year, as they returned southward on their annual migration, and a day was occupied in shooting them and slightly drying some of their meat.

In this vicinity also, signs of old Eskimo encampments were first found.

Toward the north end of the lake, sandy ridges rise behind the east shore, one at least of which is thinly wooded with white spruce, while on the west side of the lake is a rolling grassy meadow sprinkled with boulders. At the end of the lake are low, irregular and probably morainic hills of boulders.

Kazan River below Ennadai Lake.

Rapid stream. Below Ennadai Lake, the Kazan River for two miles forms a heavy rapid, over a bed of boulders, along the east side of a rather high stony hill. Then turning sharply east-northeastward it continues to flow with a rapid broken current in a winding channel, over a bed of boulders. The surrounding country is low and gently undulating, composed of gravelly till and boulders, occasionally rising in little drumlins. It is moderately well grassed, with a few groves of larch of fair size on the sides of the low ridges. At the foot of this swift water is a heavily marked path, indicating a favourite crossing-place of the caribou.

Rocky hill. A mile and a half south-southeast of this crossing-place, is a conspicuous rocky hill 150 feet high. On its western side it is seen in many places to be composed of a medium-grained red granite-gneiss, often well foliated in curving wavy lines striking west. The summit is generally covered with boulders, pebbles and glacial debris, but the gneiss projects in places, showing polished surfaces with distinct striae trending S. 50° W.

Cross striae. On the southern sides of some of the knolls on the crest of the hill, on lee surfaces and in grooves all down its western slope, are many evidences of another earlier glaciation which has left the rock, in these protected places, polished, grooved and striated. The direction towards which this glacier moved was S. 65° E. That the glacier moved in this and not in the opposite direction is clearly shown by the following circumstances:—(1) The western side of the hill itself rises in a rounded slope composed of smooth, and generally bare, well glaciated rock, while its eastern side is somewhat more abrupt and is covered with boulders and loose masses of rock, no

Evidence for direction of motion of glacier.

rock in place having been observed. (2) Salient points and angles facing westward are rubbed smooth. (3) Vertical surfaces facing south-westward, or those vertical surfaces which have been protected from the later glaciation from the north-east and are nearly parallel to and slightly facing the direction from which the first glacier came, are well polished and striated, while other vertical surfaces are not. (4) Little pits in similarly protected parts of the rock are smooth on their eastern and rough on their western sides. (5) Similarly protected salient points and angles facing eastward are not smoothed or polished. (6) The rock faces below these salient angles are also rough and unglaciated.

There is here, therefore, evidence of the existence of a névé-ground to the west of the Kazan River, at a date previous to that of the latest glaciation from the north-east.

For two miles below this crossing-place, the river flows with a swift current towards a small lake a mile and a quarter wide, which has low sandy shores, that to the east being thinly wooded with larch. Below this lakelet the river turns sharply eastward and flows for two miles and a half with a swift current between banks of boulders. To the north-west is a low wet country, moderately thickly wooded with small black spruce and larch. This is the last wooded area of any considerable extent seen while travelling down the Kazan River, though, as will be recorded later on, small patches of wood occur in favourable spots, under the shelter of the hills, all the way to Yath-kyed Lake.

Last
considerable
wooded area.

The small shallow lake entered below the woods, stretches south-eastward to the foot of a hill of gray gneiss, the north-western side of which is of smoothly rounded rock. Below this lake the party followed the rapid river, as it wound through an open unwooded country of low bouldery hills, among and through which the channel often scatters and becomes very ill-defined. Caribou were constantly seen roaming over the country in larger or smaller bands, and they often swam across the stream in front of the canoes.

At a bend in the river, north of a third small lake, is a conspicuous high sandy ridge, evidently of the character of a kame or esker, but the need of hurrying on prevented the closer examination of this as well as of many other natural features.

Esker.

From the bend two miles below Ennadai Lake, the river flows eastward, with an almost continuous rapid current in a shallow channel over a bed of pebbles and boulders, descending about 200 feet in a distance of seventeen miles measured in a straight line. The rocky

floor underlying this slope would seem to be much more irregular than that of the similar slope below Kasba Lake, but the surface is, like it, composed of till and morainic detritus.

Camp of
Eskimos.

A short distance below Sandy Hill Lake, the river bends sharply to the north, and continues very rapid for two miles, when it gradually widens, and the current slackens, until, at some sandy ridges, it opens into the south end of a narrow lake, along each side of which is a stony ridge. About the middle of the east shore of the lake several families of Eskimos were encamped on the stony beach. These camps, inhabited by family groups, appear to be more or less permanently situated at spots resorted to by the caribou in crossing the river. These animals are here speared in great numbers, some being eaten immediately, while the carcasses of the others are piled in heaps and covered with large stones for winter use. This camp might be called Kopanuak, from the name of its chief man.

Hikuatuak.

The water discharges on the east side of this lake in a swift rapid down a rocky cascade, past which the canoes were carried for two hundred yards on the north bank, over bare rock. This rock is a well foliated gray biotite-gneiss, striking N. 30° W., and with a vertical dip. Below the portage is a small lake which the party crossed in the drizzling rain, and then they descended the rapid stream, which had low stony banks, to the tent of a little old bald Eskimo named Hikuatuak, at the south end of another lake. This lake is a long irregular sheet of clear water, with low grassy shores which run into gently sloping hills, or extend in wide sandy and grassy plains. The hills are strewn with boulders, but the general appearance of the whole country is that of a level prairie, with a few elongated hills rising above its otherwise even surface. Two or three outcrops of gray gneiss were observed along its western shore, one of these being at a narrows close to the camp of Kei-ū-tōto. Attūterly's camp was passed without being visited, as it was situated at some distance off the direct route, in a bay on the left, into the bottom of which a small stream was said to flow. A few trees were seen on the hill-side beyond this bay, and we stopped to eat beside some small black spruce scrub at the north end of the lake, where a little wood could be obtained to make a fire.

Guides
secured.

From the north end of this lake, the river flows N. E. by E. for five miles in a very direct course, with a swift current, between low banks of boulders, to the south end of a lake where three Eskimo families occupied two large deer-skin tents. Hallo was the name of the chief man in this camp, and the other two men were Ahyout and Kak-kuk, father and son. The latter were induced to accompany the party as guides, and their services proved invaluable, not only in leading the

way through the intricate lakes and down the many difficult rapids, but also in obtaining a plentiful supply of caribou meat.

From Hallo's camp a long narrow sheet of water extends northward for thirteen miles and a half, broken in the middle by a light rapid, half a mile above which Annūki had a camp of two tents on the east shore. The lake has low shores, its southern expansion being generally sandy on the east, and covered with boulders on the west side. At Annūki's camp there is a stony hill on the east side, with a clump of small black spruce scrub behind it, while across the strait is a low sandy hill, breaking down in steep cut-banks on the shore. West of the northern expansion of the lake rises a high sandy ridge trending southward. Beyond the lake the river continues northward for a couple of miles, and then, doubling round the end of the sandy ridge, it flows with a constant rapid current over a bed of pebbles and boulders until it strikes against the foot of another long straight sand and gravel ridge trending N. 15° W., not improbably in the direction of the earlier of the two glaciations previously mentioned, although no glacial striae had now been observed for a long distance. On the low banks of the rapid river are a few scattered groves of small larch and black spruce bushes. On the outer side of this abrupt bend, at the foot of the gravel ridge, the gravel and boulders are piled in a high even wall by the river ice, while on the inner side is a gently sloping boulder-pavement. Some of these boulders are of red Athabasca sandstone, conglomerate, quartz-porphry, etc., the same as the rocks found north of Doobaunt Lake.

High gravel ridge.

Boulders of Athabasca sandstone, etc.

The swift stream flows along the foot of the ridge for a short distance, and then swings towards the north-east, past a hill of coarse dark-gray biotite-gneiss, striking N. 35° E., and with vertical dip, to the southern end of a narrow lake near which Ūliū had pitched his camp. Here, as at the other camps, many deer had been slaughtered, and their skinned carcasses had been covered with heaps of stones, on the tops of which were fixed several pairs of long branching antlers, to assist in finding the heaps when the ground is covered with snow in the winter. The surrounding country is low and wet, with low parallel drumlins of boulders rising here and there, all lying with their long axes S. 25° W.

Caches of deer for winter use.

The next lake is very similar to the last, being a long narrow sheet of clear water, lying in a low grassy country underlain by glacial deposits. At its north end, Nūyellik is the chief man in a camp of three tents. The river flows out of the north-eastern end of the lake, and is a swift winding stream between low banks, all along the edges of which bosses of gray gneiss crop out. At one place the rocky

points, approaching one another from each side, form a very swift deep rapid.

Five miles below the lake, as the crow flies, and opposite the camp of Eiyégiak, is a rounded boss of coarse gray diorite. The surface is clearly striated near the water's edge, the striae running S. 80° E.

A mile and a half below Eiyégiak's camp is a small lake with low shores underlain by gneiss. In a bay on its northern shore were several Eskimo tents.

The river, which had been flowing in a general direction almost due north for about sixty miles, now turns eastward and runs out of the east side of this lake. For seven miles it occupies the bottom of a channel 200 to 120 yards wide, and from twenty to forty feet deep. The current is at first light, but increases to four miles an hour. The banks descend with very steep slopes to the edge of the water, and are composed of rock and till. At the foot of this channel, where it opens out into a lake, a high, and probably rocky ridge rises from the eastern bank, the surface of which is covered with grass, and on its sides were perched hundreds of gulls. Opposite the ridge is a low rocky point of very coarse pegmatitic hornblende-granite. Its surface near the water's edge is strongly glaciated. The first glaciation, seen on the surfaces sheltered by higher points, is S. 75° W. The last glaciation, trending N. 5° E., seems to have been light, for it is to be seen on southern slopes only. It not improbably indicates a local glacier flowing down this river-valley.

Angikuni Lake.

Below this rocky ridge, where an Eskimo grave was conspicuously marked by some tall upright pieces of wood, the river enters the upper extension of a large lake, called by the Eskimos, Angikuni Kamanyie, or Great Lake, doubtless the Titmeg Lake of Samuel Hearne. Many Eskimos were camped in the vicinity, and at one time our two Peterboro' canoes were surrounded by twenty-three Eskimo kyacks. For three miles and a half our course was along the western shore of the lake, which was generally low and strewn with boulders. Beyond the eastern shore some high ridges were seen in the distance. Our canoes then passed through a shallow strait, the principal channel being doubtless further east, crossed open water, past a small island of green and red hornblende gneiss, to a rocky strait, on the south side of which was Enetah's camp, situated on the slope of some hills of well foliated red gneiss striking N. 25° E., and dipping N. 65° W., at an angle of 40°. The surface here is generally polished and shows well marked glacial grooves trending out into the lake, S. 57° E., the direction of motion of

Many
Eskimos.

Hills of
gneiss.

the glacier being clearly indicated by the rounded and polished north-western surfaces, and the curved transverse fractures in the grooves, all opening towards the south-east.

The party was here delayed half a day by adverse wind, during which time it was visited by an Eskimo trader, named Anñleah, who makes an annual trip to the trading store at the north end of Reindeer Lake, taking out the few furs collected by his neighbours, and bringing back tobacco, ammunition, needles, &c. He was greatly surprised to find that these white men were not traders, and would not even accept from him the skins of foxes or wolves, but to him, as to all the other natives who were met, small presents were given in token of friendship. He agreed to carry a letter to the trading store, and the letter reached Ottawa *via* Cumberland and Winnipeg, in safety, on March 5th, 1895.

An Eskimo trader.

Seven miles east of Enetah's camp, along a low shore strewn with boulders or angular fragments of gneiss, the party was detained for the greater part of three days on a large island off the south side of the lake, under the shelter of a hill of medium-grained reddish-gray biotite-gneiss. Observations showed this camp to be in latitude $62^{\circ} 14' 9''$, and the variation of the needle to be $24^{\circ} 30'$ east.

Delayed by a storm.

The time was chiefly spent in obtaining a vocabulary of the language of this inland tribe of Eskimos from our two Eskimo guides, who were both men of a high grade of intelligence.

Eskimo vocabulary.

The lake stretches away beyond the limit of vision towards the south-east. After leaving the island our canoe-route continued a little south of east, keeping among islands outside of the long points which project from the northern shore. Most of the islands show rocky exposures at the water's edge, above which is a covering of glacial detritus. The points first passed were of gray gneiss, while a small island seemed to be of highly ferruginous schist much reddened by oxidation, but as the island appeared to be sacred to the Eskimos, it was impossible to land on it and retain their friendship. A small island, off a point six miles from the storm camp, was found to be composed of dark medium-grained diabase, containing much pyrite, cut by many veins of white quartz. In the vicinity is a fine-grained dark mica-schist, through which the diabase is probably intruded.

Sacred island.

Diabase.

Three miles further on is a small island of dark-green almost massive chloritic schist, sloping gently on its western side and dropping more abruptly towards the east. The glacial markings are here very beautifully shown. The rock is strongly scored, but it does not appear

Three sets of
glacial striae.

to have been much rubbed down, for three distinct striations can be clearly seen in this one little rocky island. The last, on the eastern surfaces, and over all the others, but not running down north-western slopes, trends N. 30° W. The next earlier one, also shown by polished surfaces deeply grooved and scratched, trends S. 50° W. A still earlier one, seen on south-western slopes protected from the other two, trends S. 5° E.

Four sets of
striae.

The same three sets of striae are also beautifully exhibited on a rocky point half a mile to the north-east, while half a mile still further eastward is another small bare island of gneiss and diabase, which not only shows the three sets of striae mentioned above but a still earlier and very strong set trending S. 85° E. The country rock is here the coarse gray gneiss, which strikes S. 75° E. and dips N. 15° W. at an angle of 70°. It is cut from north to south by a mass or dyke of the dark-green diabase.

A little less than three miles further east, where camp was made for the night on the rocky point of a grassy island, a medium-grained gray biotite-granite crops out at the water's edge. On its western slopes are strongly marked glacial grooves and striae directed S. 80° E.

Trap dykes.

Six miles and a half beyond this camp, the river flows out of a deep bay at the north-eastern extremity of the lake. On the south side, where the current is first felt, there is a bare rocky point composed of fine-grained green chloritic schist, striking N. 55° E., and with vertical dip. It is cut, almost along the strike, by a narrow dyke of dark-green diabase, and also by a dyke of red augite-porphyrite. Under the microscope this latter rock is seen to consist of a micro-crystalline ground-mass, abundantly stained with brown iron oxide, and showing beautiful flow structure, containing phenocrysts of plagioclase, augite, biotite, sphene and apatite. The plagioclase is in irregular individuals much smaller than the phenocrysts of augite and biotite; the augite is greatly altered to calcite and chlorite; the biotite, in distinct crystals imbedded in the augite, has undergone considerable leaching, and on account of the removal of a large part of the iron, shows brilliant chromatic polarization; sphene in irregular brownish masses and strings in the biotite; the apatite is in large beautifully sharp, doubly terminated crystals. The relative ages of the two dykes could not definitely be determined. Through the schist are also some irregular veins of white quartz.

The full size of Angikuni Lake is as yet unknown, but it evidently extends a long distance towards the south-east, and is broken by many

projecting points, and long islands. The beach is generally of sub-angular boulders, while the surrounding country is a rolling grassy prairie underlain by stony till. A few small willows, and a very few stunted black spruce a foot or two in height, at the storm camp, comprise all the wood that was seen growing on its shores, and with the exception of one or two small groves, the country below it is treeless. Its elevation is about 800 feet above the sea.

River below Angikūni Lake.

Where the river leaves the lake, it first spreads out over a wide bed of boulders, becoming very shallow, and then contracts to seventy yards in width, and rushes as a deep rapid and almost straight stream, between banks which rise in gentle slopes from the edge of the water. These slopes were covered with grass and low willows. Many caribou were lazily lying down or feeding among the bushes, and turning their heads, they looked in quiet wonder at the strange apparition of the two canoes that had penetrated to the centre of their northern home. The whole landscape, seen in the early morning light, presented such a picture of wild, but quiet beauty, as I have seldom had the good fortune to enjoy.

Beautiful
landscape.

From the outlet of Angikūni Lake, the river flows eastward for forty-four miles, measured in a straight line, with a constantly varying current, at times rushing headlong down a narrow channel, and at times spreading out over a wide bed of boulders, packed by the ice into as even a pavement as the size and shape of the boulders admits of. In two places the river expands into small lakes.

For nine miles, to the first lake, low exposures of green chloritic schists outcrop here and there along the bank. On this reach of rapid river, Elrayuk and family have a camp of two tents containing twelve or fourteen persons.

Chloritic
schist.

The lakelet is three miles and a half long, and below it the river continues its headlong course between banks and ridges of boulders, passing to the north of an Eskimo camp of three tents containing about twenty persons, where Ungalluk is the chief man. From these Eskimos we obtained in exchange for needles, thimbles, etc., a supply of deer-skin clothing to protect the men of the party against the severities of the rapidly approaching winter, and also a considerable quantity of deer tallow and dried deer meat.

Subsequent to our visit on the 25th August, a party of Chippewyan Indians who trade at Churchill came as far north as Ungalluk's camp

in their search for deer, and reported the fact to us on their arrival at Churchill in November. This appears to be as far north as the Chipewyans range at the present day.

Gray gneiss.

Below the camp of Ungalluk, the river flows with an easy current to a small lake, on the north-east side of which is a straight rocky ridge apparently composed of light-gray gneiss. A short distance below the lake the river falls twenty feet over a ridge of reddish-gray gneiss, and then flows with a rapid current to a second fall, below which is a heavy cascade through a narrow rocky gap, where the river enters a gorge sixty feet deep, that being the total descent from the head of the upper fall—a distance of a mile and a half. These obstructions are passed by two portages, both on the south side, over grassy and mossy ground sprinkled with willows, the upper one being 250 yards long and the second one three-quarters of a mile. The rock, as examined closely at the lowest cascade, is a red and gray well foliated gneiss, striking S. 75° W. and dipping N. 15° W. at an angle of 40°. It is cut by a dyke of dark-green coarse-grained diorite, striking N. 60° W. straight up the river. Its surface is strongly marked by glacial grooves and striae running S. 25° E. Many of the boulders lying about are of green trap and red Athabasca sandstone and conglomerate.

Pasamut.

Four miles down the rapid stream, between bare stony hills, Pasamut is the chief man in an Eskimo camp of seven large tents and about fifty-five people. The camp was situated on a very pretty grassy terrace on the south side of the rapid stream, and at the time was well stocked with fresh fish and partly dried meat. On our arrival Pasamut gave us the very discouraging information that the river which we were descending flows into Chesterfield Inlet not far from the mouth of the Doobaunt River, but afterwards he said that it might be possible for us to leave this river below Hicolignah Lake and, carrying our canoes over a long portage, to reach the head of another river that discharges into Hudson Bay opposite the Walrus or Seahorse Islands. It was decided to attempt this latter route.

Rocky portage.

Below Pasamut's camp, the river has a general width of about 250 yards, and the channel is often obstructed by boulders or large masses of rock. The banks are composed of red till and rounded pebbles and boulders, with occasional bosses of green schist or diabase and gray gneiss. Many of the boulders are of coarse or fine red sandstone, red quartz-porphry and green diabase. The surrounding country is in general a plain of red till with pebbles but without many boulders.

For thirteen miles the river is one almost continuous heavy rapid, at the end of which distance is a portage, half a mile long, on the south

bank, past heavy broken water, where the river drops in a series of cascades over rocky ledges, descending about twenty feet. The portage is a rough one over boulders and smoothly rounded bosses of rock, which are evidently covered by the high water of the early summer. The rock is a well-foliated highly garnetiferous biotite-gneiss, striking N. 35° E., and dipping S. 55° E. < 50°, cut by a number of dykes of green diabase running S. 70° E. The lower end of this portage was found to be in north latitude 62° 15' 23".

Below this rocky portage the river flows rapidly eastward for five miles, breaking into two channels around a high oblong grassy hill, and uniting again just above four Eskimo tents which were pitched among the boulders on its right bank. Añnah, a venerable old Eskimo, Añnah with long white locks, and his old blind, white-haired wife, Otāčlik, were the heads of this family group, which seemed to consist of about twenty-seven persons all told.

To Añnah's camp, the river had kept a general course almost due eastward for eighty-four miles, measured in a straight line, from the outlet of the small lake above Angikūni Lake, but it now turned abruptly and flowed almost due northward for thirty miles, measured in a straight line, till it emptied into the western angle of Yath-kyed or Hicoliguah Lake.

Below the bend, the river continues for ten miles to flow over a bed and between banks of boulders, with a general strong current. On each side are gently sloping hillsides, in one place dotted with small black spruce bushes, the largest seen since leaving Angikūni Lake. Here is also a low exposure of well foliated red and green gneiss, striking N. 5° E. The surface is plainly scored by glacial markings running S. 25° E.

At the end of this ten-mile reach, the river opens into a small lake two miles long, with sandy shores rising in low but regular terraces. These terraces, the highest of which is about 500 above sea-level, would appear to correspond to the highest sandy shore-lines on the Doobaunt River below Doobaunt Lake, giving a measure of the depression of the land in post-glacial times, or marking the distance inland reached by the sea in those times. Marine terraces.

On the west shore of this lakelet, in a sandy valley, is a grove of larch and scrubby black spruce—the only grove of the first named tree seen on the river between Angikūni and Hicoliguah lakes. The surrounding country is a series of low rocky ridges, with grassy sides, separated by moderately level plains underlain by reddish till with pebbles and a few boulders. Last grove of timber.

At the outlet of the lake is a heavy rapid, where the water falls ten feet over a ridge of gray gneiss, cut by a dyke of green diabase 100 feet wide. The canoes were carried past this fall on a portage 140 yards long, over the slippery rock on the west bank.

For five miles and a half below the portage, the river flows with a moderate current in a channel which swings round towards the west, until it rushes with a very strong current between rocky islands, and then in a low fall over a rocky ledge. This the canoes were able to run, down a very narrow channel close to the west bank.

Sandy banks. Below the rocky islands the river widens and becomes less rapid, flowing between sandy banks, and over an almost level sandy bed, with here and there bars or low islands. The sandy soil of the surrounding country is warmer than the till, and produces a stronger growth of grass, dwarf birch and willow, and the country had the appearance of a fertile rolling prairie. Many caribou were feeding among the brush on the rich brown hillsides.

Palelluah. Ten miles below the islands is a place called by the Eskimos Palelluah, where the river is deep and narrow, and the caribou, in their migrations, regularly swim across the stream. It is probable that this is where Samuel Hearne crossed the Kazan River above Yath-kyed Lake in 1770 at a point called by him Cathawhachaga, and which he describes as a celebrated deer crossing place. He, however, places it in latitude $63^{\circ} 4'$, or $28'$ north of Palelluah and $25'$ north of where the river discharges into Yath-kyed Lake, although he states that he made several observations for the latitude.

Deep river. Below Palelluah the river is deep, with a slackening current, and the banks, instead of being sandy slopes, are rugged walls of angular boulders. The general surface is composed of rocky ridges, while some high hills, not improbably also of rock, rise on the east side of the river. The rock on the west bank is a light-gray gneiss, rather indistinctly foliated, striking N. 35° E. and dipping S. 55° E. $< 65^{\circ}$. On the very summits of most of the smooth glaciated undecayed knobs of rock, angular blocks often rise several feet, having been thrust up along jointage planes by the freezing of water under them and afterwards supported by smaller fragments of rock falling under and around them.

The surface of the knolls is striated N. 35° W., or in an almost directly opposite direction to that last seen on the river, and no signs of any other glaciation could be distinguished.

The willows and dwarf birch had now become very stunted, and *Cassiope tetragona* was seen for the first time on this river.

Hicoliquah or Yath-kyed Lake.

Kazan River gradually widens to a bell-shaped mouth, without any trace of a delta deposit, where it flows into this lake. The lake itself is an extensive body of clear water, which had a temperature of 46° Fahr. on the 31st of August. It extends as an almost open sheet of water, away to the south-east farther than could be seen from any of the points or islands on which we landed. A large high rounded island lies across the centre. The immediate shores are generally low, rising in green sandy slopes without boulders. Across the bottoms of the bays indenting the north-west shore, is a high conspicuous ridge of hills, while similar hills were seen in the distance along the north and south shores. The beach consists for the most part of a wall of irregular boulders. The north-east shore, as followed between points and islands, is twenty-nine miles in length from the mouth of the inflowing river to the head of the outflowing one. The principal underlying rock seemed to be a gray Laurentian gneiss.

A small island in latitude 62° 43' 30", six miles off the mouth of the river, is of this gray gneiss, cut by a dyke of dark-green diabase. Its surface shows strongly marked glacial grooves and striae, made by a glacier that moved N. 35° W., the direction of motion being clearly shown by numerous crescentic cross fractures opening north-westward.

Seven miles farther north, a hard massive coarse-grained gray diorite outcrops on a point on the north-western shore. The rock has a rounded surface which is smooth and fresh, and shows two very distinct sets of glacial striae, the first running S. 60° E., and a later one N. 30° W. The next point, nearly five miles distant, is composed of gray gneiss, lightly foliated N. 35° E., cut by many wide veins of coarse red granite. The point is strongly scored by the last glaciation, here trending N. 33° W.

Into the bottom of the deep bay, north of this point, Nūtarawit River is said to empty. This is a small rapid stream flowing from Nūtarawit or Dead-child Lake, which lies a short distance towards the north-west.

The next point, nearly six miles distant, where camp was pitched on the night of the 31st of August, is an outcrop of greenish-gray, irregularly foliated gneiss, striking N. 75° E., cut by a dyke of fine-grained, dark-green diabase. Its smooth fresh surface is generally covered with glacial markings. Those on the western slopes run S. 60° E., while those on the summit and eastern slopes run N. 35° W. The rest of the shore was low and faced with a wall of boulders.

Portage.

To avoid travelling around a very long point of land, the Eskimos paddle down to the bottom of a shallow bay at the north end of the lake, and then carry their canoes for 400 yards across a narrow neck of land and launch them again in the river. The portage is across a low wet grassy flat underlain by till, with very shallow water at both ends. The water reached in the river is very slightly below that in the lake, so that there are evidently no rapids in the river above this point.

River below Yath-kyed Lake.

Deep rapid.

Below the portage, the canoes descended half a mile of swift current, and crossed a small lake with low green shores for four miles to a point of coarse gray gneiss, the surface of which is striated S. 55° E. The river flows out of this little lake in a swift and narrow, but deep, rapid, over a ridge of gneiss, and then expands for a short distance between pleasant sandy beaches. For a mile the stream runs smoothly, and then breaks into a boisterous rapid over boulders and irregular ridges of gneiss. The upper portion of this rapid was descended with a line, after which the canoes were carried for 150 yards over a pavement of huge boulders on the west bank.

Bed of boulders.

For the next three miles the river continues its rapid course northward down a gently and evenly declining valley. The bed of the stream is of rounded boulders, over which the swift and clear water seemed dangerously shallow. Pitched on the right bank a small deer-skin tent sheltered an Eskimo family of three persons. A mile down the stream precipitous naked cliffs of red till overlook the water on the outer side of a bend. This till, like much of that seen on the river since leaving Augikūni Lake, seems to be composed to a considerable extent of debris of the red rocks of the Athabasca series, brought there by the south-eastward glaciation.

Eskimo camp.

The river opens into a small oval lake two miles in length, and then suddenly contracts and rushes with a current of five miles an hour down a shallow stony channel 150 to 200 yards wide, with boulders piled in massive walls on each side, through which low outcrops of gneiss project here and there.

About two miles and a half below the lake several families of Eskimos were camped on the east bank, and here it was learned positively that this river flows into Chesterfield Inlet, that there is a high fall not far above its mouth, and that there were three more camps of Eskimos on its banks. The two Eskimo guides now positively asserted that the only possible route to the sea was by continuing down the river. Afterwards, however, they acknowledged

that there was another, but much more difficult route, over a chain of ^{Alternative route.} portages, to the head-waters of a stream flowing through Kaminuriak Lake. Six additional Eskimos were employed here to assist in carrying the canoes over these portages, the agreement with them being that they should supply their own provisions, that they would be furnished with sufficient tobacco for a smoke at night, and when the portages were passed that they would each receive a box of a hundred gun caps and a twelfth of a pound of tobacco. On the fifth day, when the portages were passed, they were delighted to receive in addition half a plug of tobacco, two sewing needles and a thimble full of beads. One of the men, who knew the way, also consented to accompany the party to the mouth of the river on the shore of Hudson Bay.

On the morning of September 1st, after the above arrangements had ^{Kazan River left.} been completed, the party left the Eskimo camp and descended the rapid stony river to a little bay of quiet water on the right, where the canoes were unloaded and carried up the low stony bank to a wet grassy meadow.

We were now in latitude $63^{\circ} 8'$ —the most northerly point reached. The Kazan River had been followed for 400 miles in its rapid course towards Chesterfield Inlet, and although a portion of that stream still remains untravelled, sketches of it were obtained from the Eskimos, and from these its course has been indicated on the accompanying map. Sketches of the adjoining lakes and streams were also obtained from time to time whenever their positions could best be pointed out or located, and these are shown in broken lines on the map.

THE TWELVE PORTAGES.

From the bank, where the canoes were carried ashore, the bearing for ^{First portage.} two miles back up the river was $S. 63^{\circ} W.$, while down a straight reach of river for several miles it was $N. 10^{\circ} E.$ The canoes were now carried for 2000 yards in a direction $S. 67^{\circ} E.$ over level wet ground underlain by a gravelly till, directly towards the foot of a rather high grassy ridge, to a small shallow lake. The day was bright and clear, and a good meridian observation of the sun gave the latitude of the point reached near the north end of this lake as $63^{\circ} 7' 51''$, while ^{Observation for latitude.} the magnetic variation at the south end of the lake was found by solar compass to be $20^{\circ} 45'' E.$ These observations proved very opportune, since for the next twenty-three days the weather was continually stormy or overcast.

Second
portage, etc.

Watershed.

The shallow lakelet, which is a little more than a mile in length in a direction S. 30° E., is discharged northward into the Kazan River by a small brook. The brook which flows into it was ascended for 200 yards. Another portage 600 yards long, over flat land covered with willows, leads to a pond a quarter of a mile across, above which another similar pond, with grassy banks, is reached by a portage 190 yards in length. A fourth portage, 1300 yards long, over very wet sedgy land, by the edge of the little stony brook, brought the canoes to a point on its bank above which it was navigable for half a mile. The fifth portage, 600 yards long, was over a wet plain overgrown with small dwarf birch (*Betula glandulosa*) to a shallow pond 200 yards across. The sixth portage, over which everything was carried through a drizzling rain, is 2000 yards in length. It crosses the same wet dreary plain, keeping a little way to the north east of the brook, and at its south-eastern end reaches a narrow lake with low grassy shores. This lake, a mile and three-quarters in length, is very shallow, and its muddy banks are thickly strewn with boulders, among which the canoes must be hauled carefully by hand. The seventh portage is 150 yards long, between two lakes, over a low ridge covered with dwarf birch, and above it the canoes were pushed or paddled for half a mile across a very shallow muddy pond. The eighth portage is 1300 yards long, at first south of a very shallow arm of the pond, then across the brook, here ten yards wide, where some low bosses of gneiss project above the surface, and then over wet flat land along the north-east side of the brook, to another very shallow pond 400 yards wide. Beyond this the ninth portage, 300 yards long, leads across the same desolate plain to a shallow lake lying at the head of the brook flowing towards the north-west side of Kazan River. The tenth portage is 4400 yards long, over level wet grassy land and past a rocky knoll of dark hornblende-gneiss striking S. 60° W. and dipping S. 30° E. < 70°. The portage is across the local watershed, dividing the waters flowing towards Chesterfield Inlet, and those flowing directly towards Hudson Bay; it crosses a very small brook flowing eastward, passes to the south of a pond and ends on the boulder-beach of a narrow lake. This lake is two miles long and very shallow, so that in some places it was necessary to wade beside the canoes. A little rill, overhung with willows, flows from its south-eastern end, running noisily between banks of sub-angular boulders. The eleventh portage is 1400 yards long in an east-south-easterly direction, to a shallow muddy pond a third of a mile across, on the eastern side of which is a clump of willows four feet high. The twelfth portage is 800 yards long, and leads from this pond down a very gentle slope with a drop of twenty-five feet, through a

grassy marsh with water up to the knees, to the low, muddy and stony shore of Ferguson Lake.

This chain of portages leads across a great, gently sloping, grassy plain, between rather high grassy hills. Patches of dwarf birch are scattered here and there, and clumps of willows grow beside the brooks and lakelets. Everywhere the land is wet and marshy, the frozen soil doubtless greatly hindering the formation of drainage channels, while the two brooks are but slightly depressed below the general level. The subsoil is a pebbly till with boulders, but very few boulders can be seen except in the brooks.

FERGUSON RIVER.

Ferguson Lake, on which the canoes were launched on the morning of September 5th, is seventeen miles in length and from one to three miles in width. Its contour is very irregular, dropping back into deep bays and projecting in long points. Grassy slopes and terraces, the latter underlain by sand and gravel, rise from the beach to heights of from thirty to fifty feet above the water, above which rise bare craggy hills of gneiss and diorite. The beach is usually composed of a wall of boulders, but here and there are sandy bays, while some of the points and islands are of smooth glaciated rock.

Extent and character.

The survey of this lake, and of the rivers and lakes between it and Hudson Bay, was made during a long continued period of stormy weather, with high easterly winds which constantly dashed the waves over the canoes and often blew a heavy rain or sleet in our faces, making it impossible to see far ahead. The season was so late that it was necessary, for the safety of the party, to push onwards with all possible speed, and many places of undoubted interest had to be left unexamined. A few places, where the storm delayed us for several hours or perhaps days, were examined carefully.

From the last of the twelve portages we followed the north shore of the lake for two miles and a half, past low projecting bosses of granite, to a point of massive, coarse, gray, highly hornblendic diorite. This has a rounded surface which almost everywhere shows strong glacial grooves running S. 50° E., but there also appeared to be some occasional traces of an earlier glaciation running N. 33° W. North-east of this point, a deep bay extends away to the north, but directly southward, across the lake and past some low rocky islands, is a low point of gray gneiss and dark-green diorite. The point is well scored by glacial markings trending S. 45° E., the direction of motion being clearly shown by the curved transverse fractures opening south-east.

North shore.

Rocky
narrows.

ward. South of the shore, the hills behind a gravelly terrace appear to be of green diabase. Two miles and a half farther east along the shore the points are composed of coarse white granite, with irregular inclusions of biotite-gneiss and dark-green trap, often highly ferruginous. Two miles and a half further down the lake, the route lay through a rocky narrows, 100 yards wide, between steep rounded hills of gray gneiss, after which it followed the north-east shore for three miles, to a bare rocky island of gray gneiss and dark-green diorite. A little more than a mile and a half beyond this island, the outlet of the lake was reached, where a shallow river thirty yards wide flows down a swift rapid over boulders, descending eight feet to another lake.

Last Eskimo
camp.

A mile east of this rapid, a camp of four Eskimo tents was pitched south of the lake on a grassy terrace twenty feet above the water. These were the last Eskimos that we were to meet, and we purchased from them some tallow and a good supply of half-dried caribou meat. The lake has grassy shores, descending to a beach of boulders, and rising in regular terraces which mark the coast-lines of the post-glacial sea when Hudson Bay was very much larger than it is at present, and when it was in all probability connected with the Arctic Ocean along the line of the wide depression in the bottom of which now lies Chesterfield Inlet and Schultz and Aberdeen lakes. The lake is five miles and a half long, and at its eastern end is discharged by a small stream about fifty yards wide, which flows for a mile and three-quarters, with a very rapid current over a bed of boulders between low stony banks, into another small lake. The river flowing from this lake was said by the Eskimos to be shallow and impassable for our canoes.

Marine
terraces.

Long portage.

It was therefore necessary to make a portage from the north shore of the lake north-eastward for 2800 yards across a rather low wet grassy ridge of red till, with rounded and angular boulders, to the shore of another small shallow lake. Six Eskimos, who had accompanied us from the last camp, were paid a third of an ounce of tobacco and six gun caps each, for every trip with a load across this portage.

Half a mile northward across this little shallow lake the river was again entered. For three miles and a half it flows northward through moderately level country between banks of boulders and over a bed of boulders, but the water was at the time so low that the stream did not as a rule occupy more than half the width of the channel. The men waded in the cold water beside the canoes through much of this distance, at one place making a portage eighty yards long across a sandy point on the west bank.

At length this rapid stream emptied into the south side of a narrow lake eight or ten miles long, and to avoid the high north-west wind which was blowing at the time, the canoes crossed this lake, with some difficulty, to its north shore, reaching it at a prominent point of coarse gray gneiss. Two miles and a half farther east is a point of massive dark-green diabase cut by veins of red granite. Its surface is strongly glaciated. Its western slope is planed and grooved in a direction S. 53° E. Its eastern side, which is much more broken than the western, shows a well marked striation running S. 16° E., and older than the other, and another very light striation crossing it in a direction N. 40° E., perhaps the earliest of all. North of the lake the country rises in a high rocky ridge. The river flows out of the east end of the lake and soon breaks into a long shallow rapid over a bed of large boulders, at the top of which is a ridge of banded gray and black micaceous gneiss, striking N. 50° E. and with almost vertical dip. Its surface is distinctly scored by glacial markings trending S. 40° E.

Narrow lake.

Past the rapid the canoes were carried for 800 yards along the right (south) bank of the river, which is steep and thirty-five feet high. A terrace of boulders runs along the face of this bank, while the plain to the south is grassy, wet, and underlain by till. Here and there little tufts of dwarf birch furnished fuel for a fire at camp on the boulder terrace. The little river is about a mile long, and as it flows into the western arm of Kaminūriak Lake it spreads out over a wide expanse of boulders, past which it was necessary to carry the canoes for 250 yards, on the south bank, over naked boulders. The rocky country had now been left behind for a time, and in front of us was a broad undulating till-covered plain.

Heavy rapid.

Kaminūriak Lake is a beautiful sheet of clear cold water lying in the till-covered plain at an elevation of about 320 feet above sea-level. Its extent is as yet unknown, for although the south-western shore is only twelve miles long, its waters were said by the Eskimos to extend a long distance northward. Its northern shore, as indicated on the map, is from Eskimo information and sketches.

Kaminūriak lake.

Where seen, the beach is in some places sandy, but more generally of large boulders, which, on the more exposed parts of the shore are arranged in a regular wall to the height of from eight to twelve feet, while in the bays they are scattered over a shallow floor of sand or till. Back from the lake the country stretches in wide treeless plains, or rises in low grassy hills, which show no signs of any underlying rock.

Surrounding country.

Caribou.

Caribou were moderately plentiful around this and the two following lakes, as far as the grass-covered country extended, but it was almost impossible to obtain fuel to cook their meat, for there was very little dwarf birch to be found and no black lichen. The ice was now (September 10) forming around the ponds at night, indicating that the season of open water was almost over.

River below
the lake.

Following the south shore of Kaminūriak Lake to its south-eastern angle, the river was again reached. It was now a much larger stream, sixty yards wide and two feet deep, with banks and bed of large boulders. The stream for a third of a mile is very swift, with a drop of about four feet, and then it opens into a small lake, below which it flows in two channels, inclosing between them a large flat grassy island. The eastern channel is wide, and the current in it is light, to the head of a heavy crooked rapid, where it is obstructed by a trap dyke, over which the water falls in an irregular cascade with a drop of fifteen feet. At the foot of this cascade the western channel again joins the eastern one, having flowed for some distance along the foot of a bare rocky ridge, which, a short distance to the south, rises high above the general level. At the bottom of a bay, just above a little island at the head of the rapid, the canoes were landed and unloaded on the bare rock, and carried southward for 900 yards over a ridge of smooth gray gneiss, foliated S. 75° W., to a wet gravelly flat beside the river. The rocky ridge was covered with the coarse black hair-like lichen (*Alectoria divergens*), this being the first place in 1894 where this lichen was seen in any abundance.

Rocky
country.

Below this portage the river flows with a strong current, along the foot of the high rocky ridge, to the end of a lake which extends towards the south-east for about seven miles, having an average width of from three-quarters of a mile to a mile and three-quarters. This lake has a very regular outline and low shores of sand and gravel, which rise in gentle grassy slopes to the level of the surrounding country. From its south-eastern angle the river flows southward for two miles and a half, at first with an easy current, and then swiftly, over a wide bed of gravel and boulders, making straight towards the foot of a high hill, and at length reaching the north-west end of a narrow lake similar in size to the last. The north-western shore of this lake is generally low, composed of sand and boulders, among which are many of green Huronian schist, while beyond its south-western shore rise bare craggy hills, marking the outskirts of the rocky country which extends from there all the way to the western shore of Hudson Bay. One of these hills stands out boldly across the east end of the lake.

The rapid stream flows from the end of the lake north-eastward for two miles, till it passes the northern end of this hill in a rocky gorge, when it turns south-eastward and flows for two miles and a half among bold rocky hills, in whose protected recesses are green grassy terraces, to a heavy rapid. Here the water rushes through a narrow obstructed channel between steep walls of green diorite slightly foliated S. 60° E., and dipping N. 30 E. < 70°. The canoes were carried for 900 yards past this rapid, over a rather high ridge of the smooth Portage. green diorite, on the summit of which irregular angular blocks have been shoved up by the frost. On the smooth surface some light glacial striae may here and there be seen running S. 25° E. The hills are covered with black lichen, while some willows grow beside the little ponds in depressions in the rock. At its lower end, the portage descends to a sandy beach on the shore of a little bay of the river below the rapid, apparently quite encircled by the steep bare rocky walls.

Below the portage, the river flows eastward for two miles in a straight channel with steep rocky banks, and then passes through a small hill- Small lake. girt tarn, which we crossed in the deepening gloom of the late evening, in showers of snow and rain. Camp was pitched on a sandy grass-covered terrace at the foot of a rocky hillside, the rock in which is a fine-grained dark-green diabase, with obscure slaty cleavage striking southward, and is cut by many small irregular veins of white quartz.

Below the outlet of the tarn, the stream was descended for three-quarters of a mile down a rocky rapid, after which the canoes were carried for 800 yards along the east bank, past a rapid, over boulders and jagged points of rock. The rock is a massive light-green diorite, Green diorite. which, in the valley, is strongly scored by glacial markings trending S. 15° E. The summit of the ridge above is all blackened with lichens, but it appears to have been planed off in a direction S. 60° E., the rounded surfaces facing westward, and the broken ones eastward.

Below this portage the river is swift, but sufficiently deep for canoes, and flows between banks of similar rock, to a little fall which was run with half loaded canoes. The fall is caused by a band of white quartzite which here crosses the stream. This quartzite is distinctly and rather thinly bedded, the surfaces of the beds often showing beautiful ripple White quartzite. markings. It strikes N. 55 E., and dips N. 35° W. at angles between 40° and 60°, extending away towards the north-east as a high conspicuous straight white ridge, while towards the south-west the eye cannot follow it far among the surrounding hills of trap. Some willows grow on the southern side of this ridge, and among them was an alder bush, the first that we had seen for a long time. The quartzite is similar to that of Marble Island, and is probably of Huronian age.

Quartzite
Lake.

Below this *demicharge* the river opens into Quartzite Lake, which has a very irregular outline and lies amidst bare rounded hills that either descend abruptly to the water, or are skirted by grassy slopes and terraces marking old shore-lines of the ancient sea. On one of these terraces, seventy feet above the lake, a great number of shells of *Leda arctica* were lying just where they had been thrown upon the ancient beach.

Heavy
storms.

The progress of the party through this lake was much impeded by heavy storms. One point examined on the south shore, four miles from the mouth of the river, was a ridge of massive green trap, in places showing a vertical slaty cleavage striking N. 50° E. Its summit was smoothed and clearly scored in a direction S. 25° E., and boulders of white quartzite are plentifully scattered about, while none were seen north of the quartzite ridge. For several miles farther eastward the shore consists of similar rocky cliffs, and then it becomes low and is composed of boulders. Low stony islands surround a point composed of the scarped edge of a boulder terrace thirty feet high.

Seals.

Half a mile beyond this point the river forms up and flows in a wide and rather indefinite channel among boulders and points of rock. After a course of a mile and half, it rushes in a turbulent rapid between jutting points of rock into another small lake. Two seals were seen disporting themselves in the eddies near this rapid, one a square flipper (*Erignathus barbatus*), and the other a ringed seal (*Phoca fetida*). Here camp was pitched on the evening of September 13th. During the night the north-east wind rose to a gale, and at break of day drove before it a heavy shower of snow, which during the following night changed to torrents of rain. A delay of a day and a half was thus necessitated, but the time was improved in enlarging and correcting the Eskimo vocabulary which is given in an appendix to this report.

Eskimo
vocabulary.

Travel on the afternoon of September 15th was through the fog or drizzling rain. The course for three miles was along the low north shore of the small lake, while to the south rose rugged hills and naked rocky islands. From the north-east angle of the lake the river flows northward for a mile and a quarter, over a rocky floor, to the west end of a very irregular shallow sheet of water about four miles in length, with many low islands of till and boulders, between which there is a current in several places. Some rather high rocky hills rise south of the western end of the lake, but generally speaking the surrounding country appeared to be low and flat.

Hills of
rock.

The rapid river, which flows out of the east end of the shallow lake, was descended for a third of a mile to where the water breaks

over a ledge of rock, and here the canoes were carried for 400 yards along the north bank, to within a short distance of the shore of another small lake. The portage is a good one along the grassy and mossy bank, past a shallow rapid in which are two rocky ledges, one at the top and the other at the bottom. The rock is a massive green trap, similar to all that lately seen. The surface is well-rounded and glaciated, the summit and northern sides being strongly grooved S. 17° E. On a lee surface, well protected from the grinding of this later glacier, some strong glacial grooves were seen trending S. 60° E. No traces of any other glaciation could be detected.

The next day broke with an east wind and driving rain, and was very cold and boisterous. The wind soon went around to the north-east, and then into the north, gradually rising to half a gale. The rain turned to snow, and throughout the afternoon the storm was so severe that it was almost impossible to face it. From the portage downward the course was through a small lake, and down a rapid stream through till-covered country studded with low hills of boulders, to a swift chute where the river with heavy crested waves rushes through a narrow gap in a high ridge of similar trap. The river then passes two more shallow rapids over boulders, and enters the north-west end of a narrow lake about six miles and a half long. Two bold rocky hills rise on the north shore of this lake, but for the rest the country is generally covered with till and boulders.

This was the last lake on Ferguson River, and from its south-eastern end the stream flows in a south-south easterly direction down a regular and comparatively steep decline, in a shallow channel over boulders and low ridges of trap. After travelling six miles down the impetuous, and usually shallow current, the increasing storm forced the party to camp in the snow on a stony hillside. The surrounding country was a great stretch of low hills of boulders, probably morainic. The boulders are rounded, and there appears to be barely sufficient finer material to fill the interstices between them. The morainic hills evidently lie on an undulating floor of dark-green trap.

Throughout the 17th of September the storm continued to rage, and it was impossible to launch the canoes, but on the 18th the wind had gone down. The river continues its very rapid course south-eastward for a mile and three-quarters, and then turns abruptly eastward and flows with an easy current in a wide channel, with ridges of boulders roughly parallel to it on the south and a low escarpment of till about a mile distant to the north. For two miles further eastward it continues with varying current to a heavy crooked rapid a third of a mile long, over a

Massive
granite.

bed of rock. Below this rapid, which was run by the canoes without much difficulty, there is half a mile of easy water to the head of another short rapid with a fall of ten feet, past which the canoes were carried on the east bank, over boulders and smooth glaciated rock. The rock is a gray massive granite, with angular inclusions of fine-grained green trap. The surface is well scored by glacial markings running S. 35° E.

Reach
Hudson Bay.

For three-quarters of a mile below this portage, the river has a moderate current, and then it contracts and rushes swiftly between steep walls of granite and trap. Immediately below this short gorge it spreads over a wide bed of rounded pebbles, and flowing swiftly for two miles and a quarter passes through a rocky gap, and empties into Hudson Bay at the bottom of Neville's Bay. A band of the white Marble Island quartzite crosses the river just at its mouth. As seen from the canoe the surface of the quartzite appeared to have been eroded, and then unconformably overlain by the green trap, but it was impossible to take time to finally decide this point.

Date.

The mouth of the river was reached at noon on September 18th just a week earlier in the season than the writer had visited the same place in 1893, having then walked to it over the deep crusted snow from camp at the entrance to Neville's Bay.

The Eskimo guides were now paid off, and they hurried back up the river to show their countrymen what the white men had given them while the party of six men, in the two Peterboro' canoes, paddled southward along the coast of Hudson Bay. Assisted by favourable weather, Churchill was reached on the evening of October 1st. Some of the incidents of this part of the journey have been given in the Summary of Proceedings, while the geological and geographical details observed have been incorporated in the general account of the west shore of Hudson Bay, on pp. 86 to 98.

CHURCHILL TO SPLIT LAKE.

Winter
journey.

This route was travelled on snowshoes in the dead of winter, when the ground was deeply covered with snow, so that little could be seen but the general features of the country adjoining the line of travel. As the records are fragmentary and disconnected, they will be better understood if they are given in journal form, very much as they were entered in my note-book, the personal details and courses being omitted, the latter being shown on the accompanying map.

Leave
Churchill.

November 28th.—We left Churchill at 7.30 a.m., just at the first rosy streak of dawn, the thermometer standing at -40° Fahr., and crossed

the bay to Mosquito Point, where there is a low exposure of greenish gray arkose, similar to that behind the Mission. This was the last rock seen *in situ* until we were within a few hours journey of the banks of the Nelson River. We crossed Churchill River from Mosquito Point, over the very rough jagged ice, to the east shore. The river is here nearly a mile wide, and flows in a swift shallow rapid over a bed of large boulders, into the tidal water of the long shallow lagoon. For the rest of that day we walked without snowshoes on the ice up the river, keeping close to its east bank. The mouths of Churchill and Fishing creeks were pointed out to us as we passed them on the opposite side of the river, as well as the low willow-covered "Never-fail" Island, where the hunters from Churchill usually come every winter to shoot willow ptarmigan. The east bank of the river is low, thinly wooded with white spruce, and apparently underlain by clay and boulders. The river seemed to be shallow throughout, flowing down an even steady slope over a bed of boulders, and was still open at places where the current was swiftest. Camp was built in a grove of white spruce on top of the low east bank, behind some wooded islands.

November 29th.—The thermometer stood at -10° F. as we started at 6.50 this morning, with a moderate south-east wind blowing in our faces. We ran for six miles and a half without snowshoes on the ice, under the low but steep thickly wooded banks of the Churchill, often behind low wooded islands, to within a short distance of the mouth of Deer River. We then ascended the bank, put on our snowshoes, and started across an extensive level plain, with not a hill anywhere in sight. The snow was hard and crusted. Our course was through thin woods of small black spruce, (the first black spruce that we had seen since we had crossed Yath-kyed Lake, three months before) and then across open country skirting the east bank of Deer River. Where this river was first seen it is sixty yards wide, winding through the plain in a tortuous valley thirty feet deep. The plain is covered with moss or lichens and dotted with small lakes, and is evidently very wet in summer. Camp was made this evening in a grove of large white spruce beside the Deer River. The banks are here twenty feet high and generally very thinly wooded. The river is seventy-five yards wide and for the most part appears to be very shallow and full of granite boulders. In some of the deeper holes the ice was now twenty-five inches thick. On a sandy flat close at hand, were a number of small aspens (*Populus tremuloides*), and two or three small balsam poplars (*Populus balsamifera*), this being the most northerly point where the latter tree was seen in this district, while a

few small specimens of the former were observed on the terraces on the sides of the hills at Churchill.

Wide level
plain.

November 30th.—The thermometer stood at -6° F., with a light northerly wind, as we left the camp-fire this morning and started across a wide level plain covered with crusted snow, cutting across from bend to bend of the river which continued to flow to the west of us. The plain is generally lichen-covered, with thin groves of small black spruce and larch scattered here and there. A low ridge, probably representing an ancient shore-line, ran along to the east of the course for a short distance during the morning, but throughout the day no other hills were passed. Camp was made on the bank of Deer River, the stream being here thirty yards wide, and the banks thirty feet high and apparently of till. A bar of boulders near the camp was closely examined. All the boulders are Archæan granite, gneiss, mica-schist or hornblende-schists. No fragments of post-Archæan rocks could be found, either of Palæozoic limestone or of the Churchill arkose beds.

Boulders.

Since leaving Churchill we had travelled for about sixty miles, as the crow flies, southward, up a gradually ascending slope, and had now reached an elevation of about 175 feet above sea-level.

December 1st.—The temperature this morning was -3° F., with a light south-west wind.

Crooked
channel.

We ascended the river for about eleven miles, walking much of the distance without snowshoes. The stream retains a very constant width of twenty to thirty yards, without noticeable rapids, so that in summer it would doubtless be good for canoes. The channel is often very crooked, and the banks, which are about thirty feet high, are steep and probably of till, no signs of bed-rock being seen. At first long points of boulders project into the bends, but afterwards these become less frequent, and the stream is overhung by willows. The boulders are all of granite and gneiss, but in some places higher up the bank a few smaller glaciated cobbles and pebbles of white or buff Palæozoic limestone were observed. The sides of the valley are at first thinly wooded, but as the river is ascended the timber becomes much thicker and heavier. At the end of the above distance the river bends, coming from the south-west. Here we finally left it, and climbing its east bank walked through thin woods of small black spruce and larch, and over some little lumpy hills, probably sand-dunes, to a grove of black spruce beside a small lake, where we built a camp for the night.

Leave Deer
River.

December 2nd.—The thermometer this morning was 0° F. with a light south wind and snow. Our course all day was S. S. W.

through woods of stunted black spruce and larch, and across many small open swamps. Shortly after leaving camp we crossed two roundish lakes, each about a mile in diameter. The country generally was level, but about noon we crossed a ridge of low hills, so deeply covered with snow that it was impossible to determine their true character. No sign of rock in place was seen anywhere.

We had now entered the more or less continuous woods, and we built a camp by a brook in a thin grove of black spruce, but about six o'clock the wind shifted into the north-west, and we were obliged to build a new camp. The elevation was here about 275 feet above sea-level.

December 3rd.—Thermometer this morning—6° F., with a moderate wind from the N. W.

The forest had now become much more dense, so that it was necessary to keep men with axes walking ahead and cutting out a track for the dog sledges. For twelve miles our course was through the almost continuous woods over apparently level ground, which, however, the barometer showed to be gradually rising, till we reached the foot of a long ridge or escarpment.

The next mile was up the face of this slope, which consisted of low parallel wooded hills trending in a north-west and south-east direction. They are probably composed of sand or gravel. As shown by the aneroid, afterwards compared with the readings of the standard barometer taken at the same time at Churchill, the crest of this ridge is 600 feet above the sea-level. From its brow a magnificent view can be had of the level wooded plain that extends north-eastward as far as the eye can reach. The writer was strongly reminded of another view seen some years before, when he stood on the brow of the Duck Mountain and looked away over the similar level plain that extends from an old shore-line then beneath his feet to the west side of Lake Winnipeg. The ridge on which we stood was perfectly well known to our Indian companions, who said that it extended a long distance south-eastward, being continuous with the ridges crossed just south of Fox River, on the winter track from York Factory to Oxford House, and that it also extends in the opposite direction an unknown distance beyond Churchill and Seal rivers, being probably continuous with the sandy terraces above Yath-kyed Lake and below Doobaunt Lake. It undoubtedly represents an old post-glacial shore-line of Hudson Bay, formed when the land stood between 500 and 600 feet below its present level. As far as could be determined it is the highest raised sea-beach west of this part of Hudson Bay.

Camp was built by a thick spruce grove just behind the crest of this ridge, where many fresh caribou tracks in the snow gave us some assurance that should our stock of provisions fail, we would have a chance to secure a local supply of meat both for men and dogs.

Deep snow.

December 4th.—Thermometer this morning—1° F., with a light south-east wind. The snow in the woods was now four feet deep and very soft, and it was necessary for several men to walk ahead of the dogs and tramp it down with their snowshoes in order to make a track for the sledges; but the small feet of the dogs still went down deep through the snow of this beaten track, so that they could not obtain a good footing and had very little power in dragging the sledges. Combined with this the mild weather, and the constantly falling snow-flakes, made the running very slow and heavy, and it was necessary to harness one of the men in front of each of the sledges to assist the dogs.

Source of Owl River.

We thus travelled south-westward for about four miles, through thick woods of black spruce up to four inches in diameter, crossing a diffuse ridge, and descending its south-west slope about forty feet, to a lake a mile wide in the direction of our course, and two miles long at right angles to it. This lake was said to be the source of one of the branches of Owl River, which empties into Hudson Bay some distance north of the mouth of Nelson River. Three miles farther over the snow, amid the bristling dead white trunks of spruce that had been burnt more than eighteen years before, brought us to another small branch of Owl River, thirty feet wide, flowing in the bottom of a wide shallow valley. One of the Churchill Indians who was accompanying us, stated that he had descended this stream in four days on a raft, from a short distance below this point to its mouth, that he had encountered no rapids, and that he had seen no sign of the underlying rock anywhere. Camp was built beside this creek, among the dead spruce, where an abundant supply of firewood could be obtained. A grove of tall white spruce was growing beside the stream not far from us. The elevation was found to be 615 feet above sea-level. The surface of the country is now rough and uneven, rising into low hills and ridges, having a very different appearance from the level plain that we had been crossing for the previous six days.

Elevation.

December 5th.—Thermometer 6° F. this morning, with a light N.W. wind. Three of the men were sent ahead to break a track through the deep snow, while the others, with the dogs, remained in camp to rest, in order to avoid *mal de raquette*, which was beginning seriously to annoy some of them. The dogs were very much fagged, and most of them slept steadily throughout the day.

December 6th.—Thermometer 4° F., this morning, with a light south wind. We proceeded for eight miles over hills and along ridges with gentle slopes, through the half-open ancient brulé, the country being probably underlain by till, or at least it has the gently rounded and ridged contour commonly assumed by till. Two small branches of Owl River were crossed in this reach. Afterwards we travelled for a few miles through a wooded country, crossing a well-defined hilly ridge 100 feet high, and then a country of small swamps, and low intervening hills and ridges, the latter of which seem to have a general trend south-westward. The general deep covering of snow made it impossible to tell whether these hills were composed of gneiss or of morainic material, but they presented much the same winter appearance as the low gneissic hills in the country east of Lake Winnipeg, though there the rock could occasionally be seen on the steeper slopes, or in protected places. A caribou was shot this evening, and furnished a day's additional food for the men and dogs.

December 7th.—Temperature this morning—1° F., with a moderate south-east wind. Our course to-day was over a gently undulating country, wooded with small black spruce and larch, with intervening open bogs, across a small lake somewhat more than a mile in length, through thick woods, and then through almost open ancient brulé, along a ridge sloping gently westward to a wide shallow valley. The whole country is doubtless underlain by till or other Pleistocene deposits.

December 8th.—Temperature this morning 9° F., with a stiff south-east wind, driving before it a light shower of snow. Birch trees were seen for the first time. Our course for about six miles was southward through thick woods, at first over undulating country with small lakes, and afterwards over a much more level country with but few lakes. At length a lake was reached whose shores rise into high rounded ridges, those to the north being covered with a rich growth of dark evergreens, while those to the south are now almost treeless. Its banks, close to the water's edge, are clothed with white and black spruce and some small poplars. A run for two miles and a half south-eastward, over the ice of the lake, brought us to the head of a river thirty feet wide. We descended the river for about half a mile, when one of our Churchill Indians recognized it as the Kissé-mitiskun, or Old Fish-weir River, which he said flows into Nelson River a short distance below Limestone Rapids, and at the same time he recognized the lake just crossed as Niski or Goose Lake. We immediately retraced our steps up the river, followed the south shore of Niski Lake to its south-western angle, crossed a low ridge to a small narrow lake, on the shore of which, in a small bluff of spruce, we built a camp for the night.

Rough,
uneven
surface.

Gently
undulating
country.

First birch
trees.

Kissé-
mitiskun
River.

December 9th.—Thermometer this morning 14° F., with a light S.S.E. wind.

Wapinihi-
kiskow Lake.

We travelled over some low ridges for a mile to the shore of Wapinihikiskow or White-spruce-bluff Lake, which has been our immediate objective point since we left Churchill twelve days ago. It was said to drain into Niski Lake, and thence by the Kissé-mitiskun River to Nelson River. This lake, over which we walked for three miles, has a rather evenly rounded outline, with steep banks about thirty feet high rising to a moderately level plain or terrace, doubtless of sand or clay. The elevation of this lake is about 570 feet above sea-level, and the surface of the plane or terrace would therefore be about 600 feet above sea-level, or at the same level as the highest shore-line of Hudson Bay seen farther north a few days before.

Indian
hunters.

At the south end of the lake was a small log house, in which three Indian families were living very comfortably, supporting themselves by fishing with nets under the ice of the lake, and by hunting caribou and rabbits in the surrounding forest. These Indians—originally Crees from York Factory—now regularly carry their furs to the trading stores at Split Lake to exchange for ammunition, clothing, etc. They had cut out and blazed a good sledge-track all the way to these stores, so that there would no longer be any uncertainty as to the route that we were to follow. Here we purchased some fish for our dogs, and then crossed a low ridge to another similar lake with low even shores, beyond which we travelled for a mile through woods and swamps to the shore of Namaco or Trout Lake, which lies at the head of Mittitto or Limestone River and at an elevation of about 590 feet above the sea-level. From the west side of this lake there is said to be a portage to a stream flowing into the Little Churchill River, giving a summer route to Churchill River. On the shore of Namaco Lake was a small log house in which several families of Cree Indians were living.

Namaco Lake.

The dogs that had hauled our sledges all the way from Churchill through the soft unbroken snow were now very lean and weary. After some difficulty and considerable talk, we here succeeded in hiring a man and team of four dogs to accompany us for the rest of the way to Split Lake.

December 10th.—Thermometer this morning 22° F., with light south wind and snow.

Namaco Lake, across which we travelled for three miles and a half, has very regular outlines with but few hills near its shores. Mittitto or Limestone River flows from it near its southern end. After leaving

Namaco Lake the trail crosses a wooded ridge for a mile to Wapisew Lake. Wapisew Lake. Sakahigansis or Little Swan Lake, at an elevation of about 560 feet above the sea; it is two miles and a quarter long and is generally very similar to the others. Beyond it the trail continues through thick woods of small black spruce over low hills and ridges, and across marshes and small lakes to the shore of Wapikopow or Willow-point Lake, where we had the good fortune to shoot a couple of caribou just as we were about to build a camp on the thickly wooded bank. The day had been warm and dull with light flurries of snow, and the water in many places was standing on the ice, so that the hauling was very heavy.

December 11th.—Thermometer this morning -3° F., with a very light wind from the east, but the day was dull and mild.

Wapikopow Lake lies at an elevation of about 525 feet above the sea, and our Indian guide stated that Mittitto River flows through it, entering its northern end, and flowing out of its south-eastern side. It is about a mile and three-quarters long, but is contracted in the middle to a low willowy narrows only sixty yards wide. The shores are usually low, but towards the south-west, an esker-like sand-ridge a hundred feet or more in height, rises conspicuously above the surrounding country. From the south end of the lake the trail passes for a mile over a spur of this ridge to Wasegamow or Clearwater Lake, at about the same elevation as the last. The north-west shore of this lake here consists of high rounded hills, doubtless of sand, though it was impossible to see the surface on account of the deep covering of snow. The lake is three miles in length, and as its south-western end is approached the shores gradually decline to but a few feet above the level of the water. From the end of the lake the trail crosses a sparsely wooded ridge and descends a slope for a total distance of half a mile, to Asagiew or Crayfish Lake which lies sixty-five feet below Wasegamow Lake. This small roundish lake, less than a mile in diameter, lies in the bottom of a deep bay in the edge of the higher country to the north, which sweeps round it in an even curve, rising everywhere in a moderately steep slope to a height of ninety feet. To the south the shore is low, and the lake drains by a brook into Mittitto River. The cliff to the north is very probably underlain by Pleistocene deposits, and was very likely cut by a post-glacial river, or by the waters of Hudson Bay when the land stood 450 feet lower than at present, that being about the present elevation of Asagiew Lake above the sea.

A little more than half a mile from the lake, we reached Mittitto River, here a small stream thirty-five feet wide with low banks overhung with willows, and for two miles we followed its south bank.

through thick woods, and over small ponds with steep banks. We then climbed a steep hilly slope 120 feet high on the south side of the valley, and reached a gently undulating table-land, at an elevation of about 575 feet above the sea, where we built our camp for the night.

December 12th.—Thermometer this morning 20° F., with a moderate south wind. During the day there were occasional flurries of snow with much water on the ice, and the hauling was very heavy and bad.

The higher undulating land was crossed for several miles through woods of small black spruce, much of which had been killed by fire, and then we descended a long slope of low flat land and willow-covered swamps. Two miles and three-quarters across this low land, and over a ridge fifty feet high, brought us again to the banks of Mittitto River, which had swept around a long course and was now flowing towards the east, between stratified alluvial banks fifteen feet high. These banks are wooded with tall white spruce, which looked very beautiful after the monotony of the stunted black spruce forest. The aneroid gave this place an elevation of 340 feet above the sea. The river was crossed, and then a small lake half a mile long, on the alluvial flat, which is known to the Indians as Peeshew Pukwâgan, or Wild-cat-fishing Lake. South of this lake the sledge-road crosses a long, narrow, and undoubtedly sandy, ridge or esker, which runs as far as the eye can see both N. 85° E. and S. 85° W. Its crest is here but a few yards wide, and both sides are very steep. At the trail it is ninety feet high, but the line of the crest is undulating, and in places it appears to rise to a height of two hundred feet, where the ridge seems to be wider, with a mammillated surface. Besides some spruce it is thinly wooded with Banksian pine and some small birch, the most northern point at which the former tree was seen on this overland trip. As seen from its summit Mittitto River appears to follow the northern side of this esker eastward for a long distance.

We slid down the very steep south side of the esker, and then for half a mile travelled through hilly and evidently sandy country, thinly wooded with black spruce and Banksian pine. Four miles further, over gently sloping wooded ridges, brought us to the shore of Mûsogetéwi or Moose-nose Lake, on a small island in which we built a camp for the night. Close to camp, projecting through the snow, was a low rock exposure, the first seen since leaving Churchill River. It consists of a light gray, well foliated Laurentian biotite-gneiss striking S. 50° W., and dipping N. 40° W. < 60°. The lake has an elevation of about 320 feet above sea-level, and appears to lie along the line of outcrop of the Archaean rocks. It has generally rather

high shores, wooded with white and black spruce, birch and poplar, and its many islands are also rather high and thickly wooded. The Músogetéwi River discharges it into Nelson River, and the regular canoe-route from Split Lake to Namaco Lake passes here, the canoes being carried from this lake to Mittitto River.

December 13th.—Thermometer 13° Fahr., with a rather stiff south-east wind. The lake was crossed just as the day was breaking, and a small stream, about twenty feet wide, that flows into its southern side, was ascended for several miles. Then for four miles and a half we travelled south-south-westward over an undulating country which rises gently to a ridge, evidently sandy, twenty feet high and a hundred feet wide, wooded with birch and small Banksian pine. It runs N. 55° W. and S. 55° E., and is probably an old beach or bar, but whether it was formed in a lake, or in an arm of the sea, is uncertain. South of the ridge is a low pine-clad slope, descending towards a small willow-shadowed brook, beyond which is another rise to a diffuse ridge about the same height as the last. A mile and a half further, over almost level country, brought us to the low banks of Nelson River, a short distance above Gull Rapids, where it spreads out into Kiasko or Gull Lake. Here the survey was connected as closely as possible with the instrumental survey of Nelson River made by Mr. Klotz, of the Dominion Lands Branch, in 1884.

An island in the lake, half a mile from where we entered it, showed a number of low outcrops of gray gneiss, all smoothly planed, and with strong glacial groovings trending N. 70° W. The direction of flow of this glacier is clearly shown by the smoothed and scored eastern sides of the rocky bosses, and their unglaciated, jagged and broken western sides. The many boulders in the vicinity are all of Archean rocks. The north shore of the lake was followed westward for several miles, a point of land was crossed on a well-cut trail, and we built a camp on the shore in black spruce woods, not far from some rounded islands of well foliated gray gneiss, striking S. 15° E.

December 14th.—Thermometer this morning 27° F., with a light south-east wind. We followed the north shore of Gull Lake to its western end, and then, as the Nelson River was still quite open, we struck inland for several miles through woods and over frozen swamps, until we reached the river again at a point wooded with tall white spruce, opposite an elongated kame-like island. The next point is of red gneiss cut by dark-green diabase. Above it, it was necessary to clamber over the rough broken blocks of thick ice piled up beside the rapid stream, as far as a high cut-bank, apparently of till, a short distance above which is an exposure of a coarse dark-gray diorite,

associated with fine-grained diabase. The roar of a heavy fall was heard a short distance to the south, but we passed it without seeing it, by crossing a neck of land north of the river. We built a camp in the woods on the north bank a short distance above this fall.

Reach Split
Lake.

December 15th.—Temperature this morning—16° Fahr., with a fresh north wind. We continued to travel along under the north bank of Nelson River, which was flowing clear and open to the south of us, until we reached Split Lake, which we crossed to the trading store of the Hudson's Bay Company, where we were very kindly received by Mr. William Aiken, the trader in charge, and our journey through the unexplored country from Churchill was accomplished.

SPLIT LAKE TO NORWAY HOUSE.

Sledge road.

The journey from Split Lake to Norway House, a distance of about 225 miles by the sledge road, was made in eight days—between December 17th and 24th. It was over a well cut out sledge road, which had been more or less constantly travelled by loaded dog teams. Much of the journey was accomplished in the night, so that it was quite impossible to carry on even a roughly approximate survey, or to go even a few hundred yards aside from the course, on which we were almost constantly running to examine the country, however interesting it might appear to be. The few notes recorded below were made at points where we were obliged to stop to sleep or to take our meals.

The first day we travelled on Split Lake, running on the ice beside its rocky banks, and we camped for the night near the head of the lake within sound of the heavy falls on the Nelson River.

Ascend Grass
River.

The next morning we left the Nelson River to the east and struck up Grass River, keeping on the ice or going up into the woods for short distances to avoid rapid stretches of open water. The banks were chiefly of rounded gneiss, etc., not very high but occasionally rising into little hills. The lower intermediate land appeared to be clay or sand. All was wooded with small black spruce and aspen, with some birch and Banksian pine.

Natawéwinan

The next morning, December 19th, we travelled fifteen miles, at first through woods and then along small streams and across lakes. The general contour of the country was low and flat, with a few rocky knolls rising here and there, but the ridges, which were wooded with small spruce, Banksian pine and poplar, seemed to be generally of clay and sand. At the end of the above distance we reached a small lake called Natawéwinan or Egg Lake, on the islands in which several families of Indians were living in low log houses, fishing and hunting.

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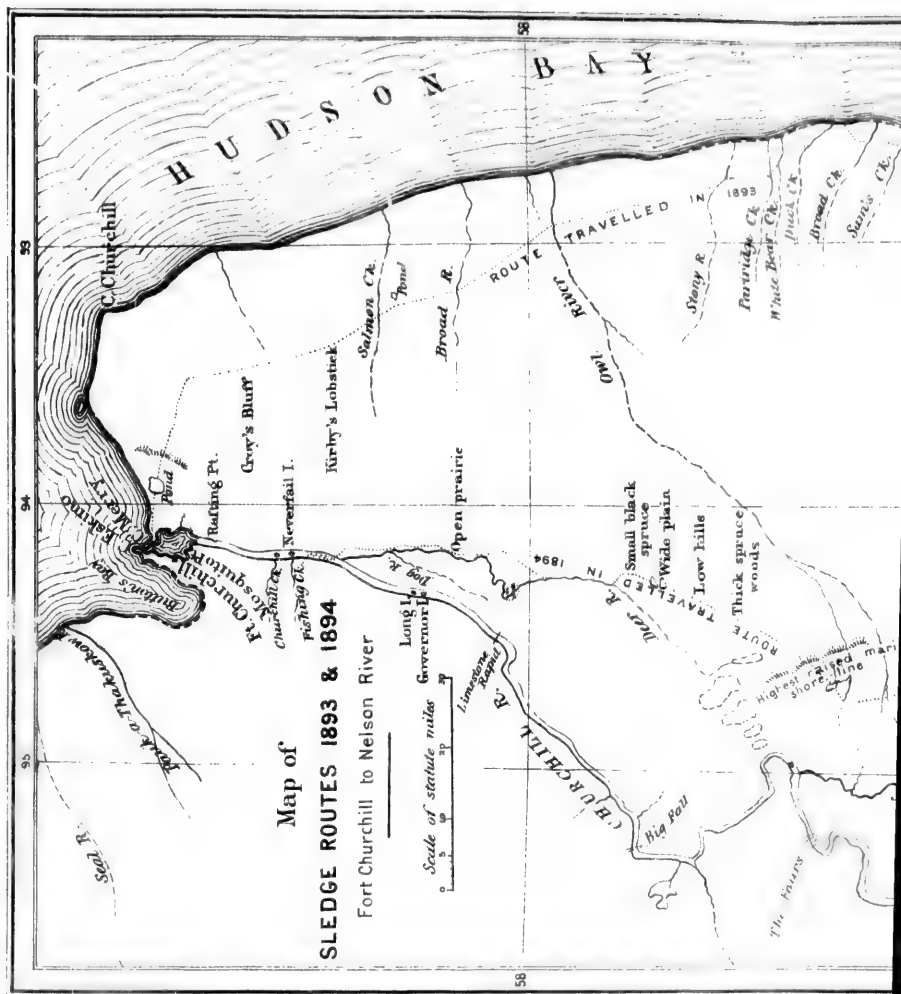
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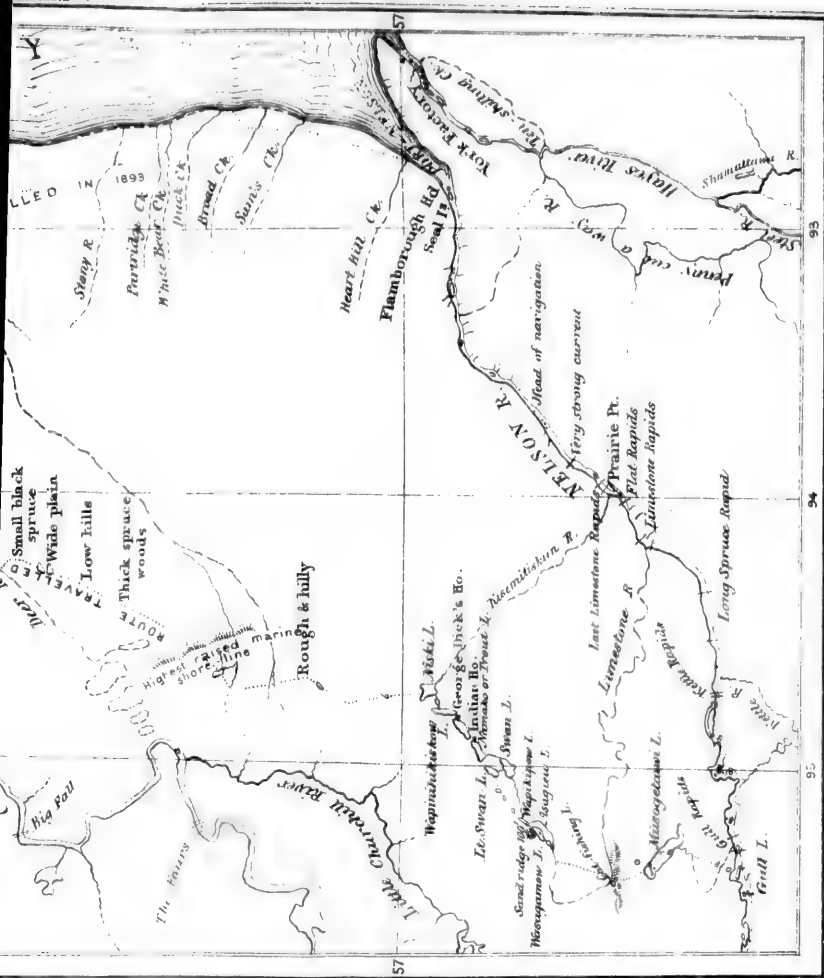
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Compiled and autographed by F. O. Simard.

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South of Egg Lake the trail continues through the woods over low hills, which are probably of sand or clay, to a small branch of Muskooskew or Grass River, where camp was built on a low pleasant point among spruce and poplars.

The next day was a stormy one with a heavy fall of snow. Our course was at first up Grass River among low rounded rocky hills, which looked strangely weird, in the gloom of the night and early morning, as we passed them through the heavily falling snow. We then crossed a small lake and ascended a very winding creek overhung with willows, after which for a couple of miles we crossed low hills and ridges, generally trending about S. 55° W., and wooded with Banksian pine and small poplar. South of the hills is a plain, probably sandy, wooded with Banksian pine, spruce and poplar, and on it we built our camp on the bank of a brook flowing southward.

December 21st.—The course was still southward for eleven miles, through thin woods of small spruce and Banksian pine, much of which had been fire-killed, over undulating country to Susaskwagamoos or Sturgeon Lake, whose white snow-covered surface was beautified by many small green islands. We crossed this lake, for three miles and a half, and continued over small lakes, and across several ridges of land wooded with spruce and fine tall Banksian pines, to some Indian houses at Cross Portage, on the north shore of Seepiwisk Lake, where a dinner of fresh moose meat renewed our strength for the remainder of the day.

Near the houses are some beautifully smoothed and rounded bosses of well banded red gneiss, striking S. 80° W. They are strongly scored by glacial scratchings trending S. 68° W. Many curved cross fractures opening south-westward, and rough lee surfaces, indicate quite clearly the direction of motion of the glacier.

We continued ten miles up the shore of the lake to a wooded point, where we camped for the night.

December 22nd.—To-day we ran about fifty-five miles, to the Hudson's Bay Company's store at Cross Lake, part of the time without snowshoes on the ice of Seepiwisk and Cross lakes, and part of the time on snowshoes through the intervening woods.

December 23rd.—After obtaining a fresh supply of provisions at the store, we continued to the head of Cross Lake, crossed Whisky Jack portage, about four miles in length, over lightly rolling and probably sandy hills, covered with spruce and large Banksian pine, travelled on the ice for a few miles over a lake, crossed another short portage, and then ran about two more miles over a lake to an island where



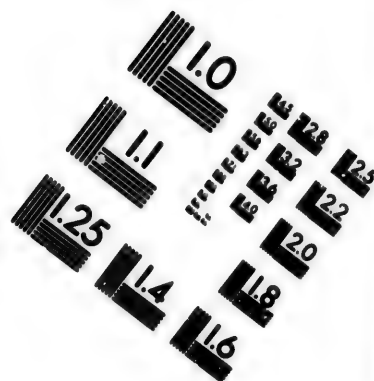
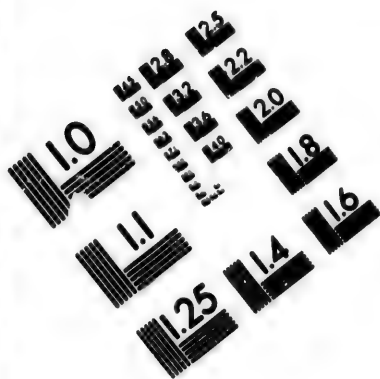
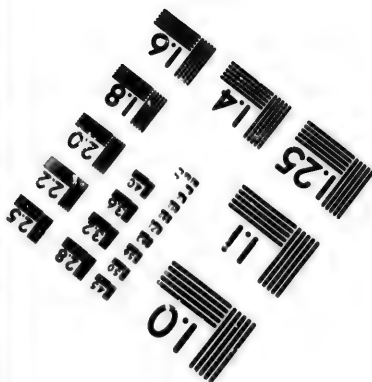
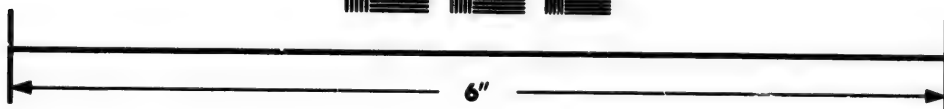
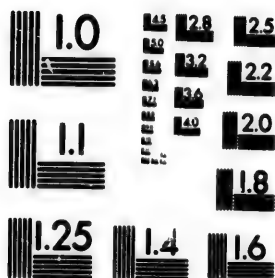


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there was an Indian house. Here we passed the night, having come about twenty-five miles.

December 24th.—We crossed the lake ahead of us, about twelve miles in length, and then struck across Ross Island for fifteen miles to Little Playgreen Lake, over a rather low country, occasionally wooded with poplar, but chiefly with small black spruce and larch. A few groves of large white spruce were found. We reached Norway House at six o'clock in the evening, having been obliged to leave one of our dogs behind us on the road, worn out by the continuous travel.

Norway
House.

We remained at Norway House four days, enjoying the kind hospitality of Mr. and Mrs. Macdonald, resting both men and dogs before starting on our final tramp across Lake Winnipeg.

PHYSICAL GEOGRAPHY.

Country
described.

The present Report refers to explorations made between north latitudes 56° and 65° and west longitudes 90° and 106° ; an area bounded on the east by the west coast of Hudson Bay, on the south by the Churchill and Nelson rivers, on the west by the Chipman and Telzoa or Doobaunt rivers, on the north by the lower portion of Doobaunt River, including Aberdeen, Schultz and Baker lakes and Chesterfield Inlet. The area thus defined includes about 300,000 square miles.

Line of
travel.

Through it a line was travelled northward from Black Lake to the forks of the Doobaunt River, while another line, roughly parallel to this, and from seventy-five to one hundred miles further east, was followed from Reindeer Lake to a point on Kazan River in north latitude $63^{\circ} 8'$. The lower eastward-flowing portion of Doobaunt River, with Chesterfield Inlet; the Ferguson River a hundred miles further south; and the west coast of Hudson Bay, from Chesterfield Inlet to Churchill, were also explored. Besides which, two lines were surveyed in winter from Fort Churchill to Nelson River.

Relief of sur-
face.

The general relief of the whole country is very low and unpronounced, much of it having the appearance of vast undulating plains underlain by sandy or stony till and covered with stunted spruce and larch, or short grass and deciduous northern plants. Here and there rise rounded rocky hills, the highest of which, in the neighbourhood of Kasba Lake, have altitudes of about 1,700 feet above sea-level. North-east of Doobaunt Lake, some prominent hills of green trap and red conglomerate form conspicuous features in the otherwise monotonous landscape. From Kasba and Daly lakes the country has a general and moderately regular slope north-eastward, until it reaches the highest raised sea-beaches or post-glacial shore-lines, after which the slope

is more directly eastward towards the present shore of Hudson Bay. South of Yath-kyed Lake and Ferguson River, the slope of the country was not directly determined, but it would seem to be almost directly eastward towards Hudson Bay.

The following are the approximate altitudes of some of the principal features of the country, obtained by a comparison of the readings of two aneroids with standard mercurial barometers read at Fort Chipewyan, Fort Churchill and York Factory, and by estimations of the rise and fall of the streams:—

	Feet.
Selwyn Lake.....	1340
Height-of-Land north of Selwyn Lake.....	1350
Daly Lake.....	1290
Doobaunt Lake.....	500
Baker Lake.....	20
Kasba Lake.....	1270
Ennadai Lake.....	1100
Angikūni Lake.....	800
Yath-kyed Lake.....	300
Kaminūriak Lake.....	320
Highest shore-line, S. W. of Churchill.....	600

The country may conveniently be divided into two distinct portions, one of which may be designated as the "Interior Upland," and the other the "Coastal Plain."

The Interior Upland lies south-west and south of Doobaunt and Angikūni lakes and has a mean elevation of from 900 to 1000 feet above the sea. Its surface is composed largely of sandy till and rounded boulders or broken fragments of rock, the latter of which are chiefly derived from rock in place somewhere in the vicinity. Low drumlinoid ridges of boulders are common over the surface, and rugged irregular hills of boulders mark the positions of moraines of the Keewatin glacier which centred in the northern part of the area. Long straight sandy ridges or eskers stretch across the country, extending in uninterrupted courses over the surfaces of hills and valleys alike. A few gravel beaches mark the shores of some small extra-glacial lakes, which existed in some places when the Keewatin glacier was finally retreating towards its centre of accumulation.

The Coastal Plain lies between the highest ancient post-glacial sea-beach and the present shore of Hudson Bay, sloping gradually from a height of 500 or 600 feet above the sea, down to sea-level. Much of the surface is composed of stony till, like that of the Interior Upland, but the till is diversified with sandy plains, and on all the steeper slopes gravel terraces or coast-cliffs mark the lines of the old sea-shore. Many of the terraces fill narrow gaps between adjoining hills, and the lower ones are often strewn with shells such as are found in the adjoining sea

at the present time. The waves have reduced the surface irregularities of this portion of the country to some extent, but the more rocky portions in the vicinity of Chesterfield Inlet, are still, except for the presence of the little terraces, as rough and rugged as before they were covered by the sea, and the higher parts are probably barer, for any loose material that had been left by the glacier has been washed by the waves into the depressions. Farther south many of the stony hills seem to have been very little modified by the action of the waves.

The breadth of this plain in the vicinity of Fort Churchill is probably about fifty miles. Farther north it becomes broader, until in the latitude of Yath-kyed Lake it has a breadth of about 125 miles, and at the north end of Doobaunt Lake it has a breadth westward of 300 miles. North of the Doobaunt River its extent is not yet known, but many of the sand plains and terraces reported from the banks of Back's River probably mark old shore-lines on this coastal plain, there sloping northward to the Arctic Ocean.

River valleys. As in the country south-west of Lake Athabasca, the rivers, however large or rapid, have not excavated deep valleys, and very often they flow in ill-defined channels over beds of boulders or rude fragments of broken rock. Whatever valleys may have existed in pre-glacial times were filled with glacial detritus during the glacial period. Since the disappearance of the Keewatin glacier, the streams have had very little power of erosion, for they are frozen up most of the year, and each spring, as they open, the ice packs the boulders that form their banks into massive walls which resist erosion almost as effectually as the unbroken rock itself. Besides this, the time since the disappearance of the glacier may not have been very long.

Watershed The watershed, dividing the streams flowing westward into the Mackenzie River and those flowing eastward into Hudson Bay, strikes along the height-of-land north of Selwyn Lake, and thence turns southward to Wollaston Lake, through the centre of which it passes, for this large lake has two almost equal streams flowing from it in opposite directions.

Chipman River. Chipman River discharges its waters into the Mackenzie. It flows from Selwyn Lake, which has an elevation of 1340 feet above the sea, and, together with this lake, it has a total length of ninety miles. In its upper portion it is a beautiful quiet stream, broken by but five rapids, which are passed by a similar number of portages, with an aggregate length of a mile and a quarter. Its lower portion, below Chipman Lake, is a wild broken torrent. The Indians do not attempt to navigate this part of the stream in their canoes, but they traverse a chain of six small lakes which are connected with each other and with

Black and Chipman lakes by seven portages, having an aggregate length of four miles.

The remainder of the country is drained by streams that flow more or less directly into Hudson Bay. Three of these have been examined, viz.:—The Doobaunt or Telzoa, the Kazan and the Ferguson, while two of the upper tributaries of the Thlewiaza River were also explored. Of the remaining streams, shown in dotted lines on the accompanying map, the mouths of some were seen on the shore of Hudson Bay, beyond which, all that is known of them, was learned from Eskimos or Indians.

Streams flowing to Hudson Bay.

The Doobaunt River, the largest of the above-mentioned streams, rises in Daly Lake, at an altitude of 1290 feet above the sea, and flows north-northeastward for 285 miles, following its windings, to Doobaunt Lake, descending in this distance about 790 feet. Of this distance 175 miles is through the quiet water of larger or smaller lakes, while 110 miles is running water, which thus has an average descent of rather more than seven feet to the mile. The channel is shallow, and the banks and bed are both usually composed of boulders. Doobaunt Lake is a body of fresh-water of unknown extent, which, in August, 1893, seemed to be largely covered with still unbroken ice. Its shores descend in grassy slopes, and are the favourite feeding grounds of numerous bands of caribou.

Telzoa or Doobaunt River.

Below Doobaunt Lake, this river continues its course north-north-eastward for 142 miles, to the Forks, 94 miles of which is running water. In this distance is the heavy rapid above Grant Lake, in which the river descends 100 feet in two miles and a half.

At the Forks, the river turns abruptly eastward, and, passing through Aberdeen, Schultz and Baker lakes, discharges into the head of Chesterfield Inlet. Its total length from the head of Daly Lake to this point is 750 miles. If to this is added Chesterfield Inlet, extending from the mouth of the river to the west coast of Hudson Bay, the total length of the Doobaunt or Telzoa River is 875 miles.

The Kazan River rises in Kasba Lake, which lies fifty miles east of Daly Lake, and at about the same elevation. From this lake the river flows for 220 miles north-northeastward, parallel to the course of the Telzoa River, to the west end of Augikūni Lake. Throughout this distance the shores are sloping, and largely composed of boulders or boulder-strewn till. From the west end of Augikūni Lake the river turns sharply eastward for ninety miles, and then northward for thirty-five miles to the south-west angle of Yath-kyed Lake. Yath-

Kazan River

kyed Lake has here a width of thirty miles, and appeared to extend a long distance south-eastward, for its south-eastern shore could not be seen from any of the hills ascended. From Yath-kyed Lake the river was again followed for twenty-five miles north-eastward, below which it has a probable length of ninety miles to its mouth on the south side of Baker Lake, giving it a total length of 490 miles. In its course it is not only approximately parallel to the upper portion of Telzoa River, but is also roughly parallel to the west shore of Hudson Bay.

Thlewiaza River.

Two of the upper tributaries of Thlewiaza River were examined, for an aggregate length of 100 miles. One of them heads in some small lakes on the north side of the moraine north of the head of Cochrane River, while the other rises near the south end of Kasba Lake. Flowing in almost opposite directions, through a boulder-strewn country, they unite their waters in Theitaga Lake, from which the Thlewiaza or Small-fish River is said to flow eastward to the west coast of Hudson Bay.

Cochrane River.

Cochrane River is one of the two almost equal streams that discharge the waters of Wollaston Lake. It flows from that lake north-eastward, following the general course of drainage adopted by the above-mentioned streams. In latitude $59^{\circ} 7'$ it strikes against a heavy moraine and by it is turned sharply southward. From this point it continues to flow in a southerly direction for 120 miles, until it empties into the north end of Reindeer Lake. Its total length is about 180 miles.

Ferguson River.

Ferguson River rises in Ferguson Lake, in latitude 63° , about twenty miles east of the north end of Yath-kyed Lake, and flows east-southeastward, parallel to Chesterfield Inlet, and at right angles to the course of Kazan River, directly into the west side of Hudson Bay. Its total descent, from source to mouth, is about 100 feet, and its total length is about 180 miles. In its lower portion it flows through a country of bare rocky hills, but the lakes in its upper portion lie in the midst of undulating grassy prairie.

Hudson Bay shore.

The shore of Hudson Bay has been described in some detail in a preceding part of the report. From Chesterfield Inlet, which is as far north as is known to the writer, southward to Wallace River, it is composed largely of bare rounded Archean rocks, which descend rather steeply into the sea. In some places deep water extends up to the foot of the rocks, while in other places a terrace of sand and boulders, about the level of mean tide, extends seaward from the foot of the cliffs, forming shallow water for a few hundred yards from shore. In a few places strings or bars of boulders extend outwards a consider-

able distance from the rocky points. Many of the islands are bare rounded knolls of rock, while others, and especially those off the mouth of Neville Bay, are composed largely of sand and boulders.

From Wallace River to Churchill, the shore descends to the water with a much more gradual, even slope, and any rock exposures seen were low knolls of granite and gneiss rising but a few feet above the surrounding turf. This gentle slope continues seaward for many miles, and the beach, between high and low tide, usually several miles in width, has the appearance of a great muddy boulder-strewn plain.

Flora.

The region may also be divided into Forests, and Treeless Plains, or "Barren Lands," by a line which curves around the bottom of Button Bay, and then continues within sight of the shore as far as Hubbart Point, beyond which it strikes north-westward, almost at right angles to the magnetic meridian, crossing Kazan River at the southern Narrows of Ennadai Lake, and Telzoa River about the middle of Boyd Lake. Forest.
limit.

The forested country is chiefly wooded with small black spruce (*Picea nigra*), and larch (*Larix Americana*), while the lowlands are almost everywhere covered with deep mossy swamps. Proceeding northward the woods become confined to the lowlands and the tops of the hills remain treeless. Such are the conditions of the surface around Kasba and Daly lakes. Further northward the wooded plains give place more or less suddenly to level or rolling grassy plains, which constitute the Barren Lands. As the forest disappears, much of the surface is covered by deep frozen mossy bogs or tundras, but these occur only along the edge of the forest, and do not form part of the Barren Lands proper. Black spruce
and larch.

Besides the two species of trees above mentioned, the white spruce (*Picea alba*), grows to quite a large size on some of the dry eskers, and on the stony, well-drained, banks of the Telzoa River. It extends northward almost to Doobaunt Lake, forming a larger tree than either of the others. At Fort Churchill, near the shore of Hudson Bay, small white spruce were found to have entirely replaced black spruce in the swamps. A few miles farther inland, black spruce again takes its normal place in similar swamps, and white spruce almost disappears. White spruce.

Banksian Pine (*Pinus Banksiana*) grows on the sandy plains along Stone River, and northward, on dry sandy ridges, as far as Selwyn and Theitaga lakes, but it does not extend as far north as spruce or larch. Banksian
pine.

Canoe-birch. Canoe-birch (*Betula papyrifera*) grows to a fairly large size on the esker at the head of Thlewiaza River, but as a rule it is a small tree in this region. It gradually decreases in size and disappears at the edge of the Barren Lands. Some small aspen trees (*Populus tremuloides*) was seen as far north as Daly Lake on Telzoa River, latitude 60° on the head-waters of Thlewiaza River, and at the mouth of Churchill River on Hudson Bay.

Barren Lands. The Barren Lands, or more properly the treeless plains, characterize the larger part of the country depicted on the accompanying map. They consist very largely of rolling plains, underlain by stony till, and covered with short grass or sedge. Doubtless the ground is permanently frozen at no great distance below the surface, and the surface in summer is almost constantly wet, like the plains of Assiniboia and Saskatchewan in early spring. Rounded rocky hills rise here and there through the clay, and on these, as well as often on the more stony parts of the till, the surface is dotted with a thick growth of lichens, such as *Alectoria ochroleuca*, *A. divergens*, and *Cetraria Islandica*. Many flowers brighten these plains during the short summer. A list of these, with the other plants, will be found in Appendix III.

Isolated groves of timber.

On the banks of the streams that flow northward from the forest country, scattered groves of spruce and larch were met with far out into the Barren Lands, and their positions are marked on the accompanying map. It is also evident, from the amount of drift-wood found at the forks of Doobaunt River, that groves exist on the west branch of that river, not very far above the forks. Some Eskimos, stopping at Churchill, also reported that there is an isolated wooded area, within the Barren Lands near the head-waters of the Thaanné River.

Fauna.

The following is a synopsis of the notes made concerning the fauna of the district:—

Fish.

Fish seemed to be everywhere abundant in the lakes and streams, though very few were caught. The lake trout (*Cristivomer nainaycush*) and whitefish (*Coregonus clupeiformis*) appeared to be the most abundant and valuable food fishes, the latter being especially abundant in Doobaunt Lake. Pike (*Esox lucius*) and one or more species of suckers, were also seen. It is probable that some of the true salmon ascend the inlets and streams west of the northern part of Hudson Bay, but the fact was not definitely determined.

Birds were remarkably scarce throughout the whole region. A flock of the beautiful Bohemian Wax-wings (*Ampelis garrulus*) were seen in a grove of birch trees, near the shore of Theitaga Lake, on their breeding grounds. Water-birds were scarce in the interior, back from the shore of Hudson Bay. Ducks were rarely seen, for the clear water of the lakes and streams does not seem to furnish them with food, but the American Merganser (*Merganser Americanus*) was occasionally seen near rapids. Both the Common and Red-throated Loons (*Urinator imber* and *U. lumme*) were common in the smaller lakes, and made the nights hideous with their screechings. Towards the shore of Hudson Bay the Black-throated Loon (*U. arcticus*) was also occasionally seen and was often heard. Near the north shore of Doobaunt Lake a brood of Canada geese (*Branta Canadensis*) was seen, and several flocks were observed later in the year on the sandy plains near the west end of Aberdeen Lake.

The Canada and Ruffed Grouse (*Dendragapus Canadensis* and *Bonasa umbellus*) are not uncommon in the wooded country, and the Sharp-tailed Grouse (*Pediacetes phasianellus*) was seen near York Factory. The Willow and Rock Ptarmigan (*Lagopus lagopus* and *L. rupestris*) were abundant in summer throughout the Barren Lands, and the former species collects in great numbers in the woods as soon as winter sets in.

Moose (*Alces Americanus*) were found on Stone River, but were not found farther north. Barren-ground Caribou (*Rangifer Groenlandicus*) roam in scattered herds almost everywhere over the Barren Lands. One vast herd, which at the time was estimated to contain from one to two hundred thousand deer, was seen on the shore of Carey Lake. These deer were migrating southward towards the edge of the woods, where they would spend the winter. Musk oxen (*Oribos moschatus*) seem to be confined to the country north of that portion of the Doobaunt River between Doobaunt Lake and Hudson Bay. None were seen in the course of either of the two expeditions, but the Eskimos at the head of Chesterfield Inlet had a number of fresh skins. The Eskimos on Kazan River reported that there were no musk oxen in their neighbourhood.

The wolf (*Canis lupus occidentalis*)—both gray and white varieties—were found in this region, the former roaming northward a little beyond the limit of the timber, the latter being common throughout the Barren Lands. During the summer, while the young pups are unable to travel far, the wolves remain in families in one locality, but during the autumn and winter they roam from place to place.

- Foxes. Red, black and cross foxes (*Vulpes vulgaris*) range as far north as the northern limit of timber, but they do not extend over the Barren Lands. The white fox (*Vulpes lagopus*) is found everywhere on the Barren Lands, but more especially along the coast, where it
- Wolverine. appears to be very numerous. The wolverene (*Gulo luscus*) is one of the most common carnivorous animals throughout the whole region. It doubtless lives on any of the other animals that it is able to overcome, but it would seem to be particularly adept at hunting cariboo. In one instance four of these animals were following one full-grown deer, and they seemed to be driving it gradually down into a lake.
- Marten. Marten (*Mustela Americana*) are particularly abundant in thin woods in the more southern part of the district. Otter (*Lutra Canadensis*) also live on the banks of the streams throughout the wooded country, but neither of these two species appeared to extend into the Barren Lands.
- Bears. The Black Bear (*Ursus Americanus*) has a similar range towards the north. White Bears (*Thalassarcos maritimus*) were seen on several occasions near the shore between Wallace River and Churchill, but they are no longer abundant, as they would appear to have been a century or more ago. The Arctic hare (*Lepus glacialis*) was found to range everywhere throughout the Barren Lands from the edge of the woods northward, but it was nowhere found in any abundance.
- Hare.
- Natives. A few bands of Chippewyan Indians inhabit the more southern portions of the region shown on the accompanying map, roaming northward towards the edge of the Barren Lands. They live chiefly on the fish which they catch in the rivers and lakes, and on the Barren-ground Caribou, which they kill in large numbers as these animals attempt to swim across the rivers and narrow parts of lakes. During the winter they trap some fur-bearing animals, chiefly martens, which, in the spring, they take to the traders at Lake Athabasca, Reindeer Lake, or Churchill, and exchange for guns, ammunition, hardware, tobacco or such other articles as they may need. They then scatter to the lakes, where they live on fish throughout the summer. In the autumn they again return to the traders, with a few more furs, after which they depart into the woods to live in their tents, or camps made of brush and moss, for the winter, and are usually not seen again until the following spring. They are timid and sombre in disposition, and rarely make any exuberant display of either joy or sorrow.
- Chippewyans.
- Eskimos. The Eskimos, who live chiefly on the banks of Kazan River, north of the edge of the woods, are quite different in disposition from their morose neighbours to the south. Active and volatile, they have no

hesitation in exhibiting their emotions. One moment they would be uproariously happy, and the next they would be shedding floods of tears.

The tribe of Eskimos met with in the summer of 1893 and 1894, live almost entirely on deer, which they spear from their kyacks while the animals are swimming in the water. Several hundred carcasses of deer might be seen around one camp, and what were not immediately used, were piled in heaps, and buried under large stones, so that they would be safe from wolverenes, and available for use during the following winter. Their clothing, both for winter and summer is made of deerskin, and their kyacks, or single canoes, are made of deerskin parchment, sewed over a light wooden frame. Food and clothing.

This tribe of Eskimos appeared to number between five and six hundred souls. They seem to live entirely inland, and thus to differ from the maritime seal-hunting Eskimos who inhabit all the Arctic coasts from Greenland around to Behring Sea. Number.

Their language is very distinct from the Eskimos of Labrador and the north side of Hudson Straits, and also from that of the Eskimos of the delta of the Mackenzie River. A vocabulary of about 300 words was taken down with great care from one of the two men who accompanied us down the Kazin and Ferguson rivers, and is given in Appendix II. Language.

GEOLOGICAL SUMMARY.

The rocks and geological features described in detail in the preceding portion of this Report, may be briefly classified according to the following scheme :— Classification.

Recent.

Present shore-lines of Hudson Bay, and of the lakes in the interior. River channels, with their low and often stony banks. Weathered and fractured rock surfaces.

Pleistocene.

Old shore-lines of the sea, rising to heights of from 500 to 600 feet above the present sea-level, marked by gravel beaches, coast-cliffs, terraces, etc. Old lake shores, such as those of Hyper-Kasba Lake, sand plains, &c.

Till, Drumlins, Moraines, Eskers, Ispatinows.

Silurian.

Loose masses of limestone at Churchill, which have evidently been derived from rock in place somewhere in that vicinity.

Cambro-Silurian.

A small outlier of Trenton limestone on an island in Nicholson Lake. A still smaller outlier near Fort Churchill. The limestone on Sturgeon and Beaver lakes.

Cambrian.

Athabasca sandstone and conglomerate. Masses and dykes of dark-green basic eruptive rocks, such as pitchstone, diabase, minette, etc. Flows and dykes of reddish acid eruptive rocks, such as rhyolites or quartz-porphyrries, andesites, augite-porphyrries, etc. Churchill arkose.

Huronian.

Marble Island (white) quartzite. Greenish quartzite, intimately associated with eruptive rocks. Diabase and gabbro.

Laurentian.

An undifferentiated mass of granite and granitoid gneiss, undoubtedly representing in the main the Fundamental Gneiss of other parts of the Protaxis, in regard to the age of which very little new information has been obtained in this region. With these rocks, on the north shore of Baker Lake, are associated some bands of reddish crystalline limestone, possibly representing parts of the Grenville series of the better-known parts of Canada.

LAURENTIAN.

Application of
name.

The name Laurentian is thus here applied almost exclusively to the crystalline, massive, or altered, crushed and contorted rocks of the Fundamental Gneiss or "Basement Complex," consisting of granites and diorites, and granite and diorite-gneisses which it has so far been impossible to separate in any definite time-series.

Granite and
gneiss.

As a rule, the massive and gneissic rocks are very similar in composition, and, in the opinion of the writer, are different phases of development of the same fluid or semi-fluid magmas, though in different places and at different stages in development of the crust these magmas have differed considerably in composition. On the north shore of Baker Lake, the gneisses, as above stated, are associated with bands of red crystalline limestone similar to those found in the Grenville series in southern and eastern Canada, but nothing definite was determined respecting the true character or origin of these bands. Some portions had a decidedly clastic appearance, but it seemed very difficult to draw any line between these and the surrounding granitoid gneisses.

Crystalline
limestone.

As yet, it is very uncertain what proportion of the region shown on the accompanying map is underlain by these rocks, but the three north-and-south lines of travel explored would seem to indicate that they underlie most of the country between latitudes 59 and 62', though from this must be taken the Huronian area around Kasba and Ennadai lakes. On the most westerly line of travel, the granites and gneisses extend northward from Black Lake to Doobaunt Lake. Thence they continue north-eastward along the west shore of Doobaunt Lake and down the Doobaunt River to Lady Marjorie Lake, though throughout this distance they are often in contact with the overlying Huronian and Cambrian rocks. North of Lady Marjorie Lake the Laurentian rocks disappear under the Cambrian strata, and they are not again seen until the Cambrian belt is crossed and the north shore of Schultz Lake is reached.

On the second line of travel, the Laurentian rocks underlie the country from Reindeer Lake northward, across the head-waters of Thlewiaza River, to Kasba Lake, throughout which distance they appear to be largely represented by massive granites. From the south end of Kasba Lake, northward for seventy-five miles, the country is thickly covered with drift, but the few rock exposures seen, and the abundance of broken angular rock-masses, indicated the presence of an area of Huronian.

From Ennadai Lake north-eastward, to beyond Yath-kyed Lake, with the exception of a small Huronian area near Angikūni Lake, granite and gneiss seemed to be the prevailing rocks.

On the low flat shore of Hudson Bay, between Seal River and Cape Esquimaux, few rock exposures occur, but those seen consisted of granites and gneisses of typical Laurentian aspect. For forty miles north of Cape Esquimaux, no rock in place was seen, and thence north-eastward to Baird Bay some of the points consisted of granite and gneiss, though the shore generally consisted of Huronian rocks.

The country along the upper portion of Ferguson River is also underlain by Laurentian gneisses.

Similar granites and gneisses occur along the north shore of Baker Lake, and down both shores of Chesterfield Inlet to its mouth, whence they extend southward along the shore of Hudson Bay to a short distance north of Baker's Foreland.

HURONIAN.

The largest area of Huronian rocks found in this district, extends more or less continuously for 120 miles along the west coast of Hudson Bay, from near Baker's Foreland to a point forty-five miles north

of Cape] Esquimaux. [From the shore of Hudson Bay inland, up Ferguson River, they were traced for seventy miles.

Another area was crossed while descending the Telzoa River between Schultz and Baker lakes. A third occurs on the Kazan River below] Angikūni Lake. A fourth appears in the basins of Kasba and Ennadai lakes. Fifth and sixth areas are represented by outcrops of white elastic quartzite on the north shore of Doobaunt Lake, and on the east shore of Wharton Lake.

The rocks constituting this system may be divided into three more or less distinct groups, viz. :—The Marble Island quartzites; the greenish quartzites and graywackes; and the more or less highly altered and often schistose diabases and gabbros.

Marble Island
quartzite.

The Marble Island quartzites are composed of hard white quartzite consisting of more or less rounded grains of quartz, of moderately regular size, cemented together by interstitial silica. They are very distinctly bedded in thick or thin beds, and the surfaces of the beds are often covered with beautiful ripple-markings. The heavier beds also often show distinct false-bedding. They are usually in a more or less inclined attitude, but they were nowhere seen to be very much crumpled or squeezed into minute folds. Their total thickness was not determined.

These quartzites were first noted by Dr. Bell from Marble Island, and though this island was not examined by the writer, rocks of undoubtedly similar character to those described by Dr. Bell, were seen at many places on the shore, and consequently the name is here retained.

In one place, near the *câche* on the west shore of Hudson Bay, a thickness of sixty feet of this quartzite, in a nearly vertical attitude was seen almost in contact with the Laurentian gneiss, there being but a narrow drift-filled gap between the two. This would indicate either the existence of a fault, or that here the quartzites are the base of the Huronian, or that the gneiss represents an eruptive rock which has risen up through or into the Huronian subsequent to the deposition of the quartzites.

The white quartzites on the north shore of Quartzite Lake, dip regularly north-westward, away from the hills of diabase to the south, and the latter, therefore, probably underlies the quartzite, though it is not necessarily older than it. In other places very little evidence was obtained as to the relative ages of the white quartzite and the other parts of the Huronian. However, it would seem not improbable that this Marble Island quartzite is the oldest part of the Huronian in the region near the shore of Hudson Bay, and that the diabase, and other

basic eruptions which are associated with it, have been intruded beneath it, and have also flowed over it.

That the Marble Island quartzites were once extensively spread over a large portion of the region under consideration, is shown not so much by the few scattered outliers mentioned above, as by the fact that the overlying Cambrian conglomerates, covering such large areas south-east of Lake Athabasca, and between Doobaunt and Baker lakes, are composed largely of pebbles of this white quartzite, while the Churchill arkose also contains pebbles of similar clastic quartzite.

In the vicinity of Kasba Lake, numerous boulders and angular fragments of Huronian rocks were seen, among which were many of greenish quartzite, and coarse schistose conglomerate containing large rounded pebbles of gneiss, indicating the presence of these rocks in the immediate vicinity, but the rock itself was not seen.

Dark-green eruptive rocks, chiefly diabase, often very much squeezed and altered, are largely developed in the Huronian, composing a considerable proportion of the rocks of this system. On the west coast of Hudson Bay, these rocks are cut by many veins of white quartz, highly charged with iron- and copper-pyrites. Eruptive rocks.

Associated with the massive diabases, and often indistinguishable from them except on close examination, are many beds of fine-grained, often schistose, graywacke, or greenish quartzite, which appear to have been caught up in, or surrounded by, the eruptive rocks. Whether they have formed a portion of the Marble Island series, or whether they are quite independent of it, has not been determined, but the former hypothesis would seem to be the more probable. Graywacke.

CAMBRIAN.

The Athabasca sandstones and conglomerates represent the basal portion of the Cambrian in the northern part of the country shown on the accompanying map. They consist of 400 feet or more of reddish thick-bedded sandstone or conglomerate, often showing false-bedding, and are comparatively unaltered and undisturbed over large areas. In some places, as on the islands near the north-west shore of Doobaunt Lake, they dip regularly at a moderate angle. Athabasca sandstone.

The rock varies from a coarse conglomerate to a fine-grained red mottled sandstone. The pebbles in the conglomerate are well-rounded and waterworn, and consist almost entirely of white clastic quartzite like that of the Huronian. The occurrence of quartzite pebbles, to the almost total exclusion of pebbles of Laurentian rocks, would indicate that these Cambrian strata were deposited off a shore composed very largely of Huronian quartzites. Composition.

Acid eruptives.

The Athabasca sandstones are cut by dykes and masses of both acid and basic eruptive rocks. The acid eruptives were first met with in a hill of red quartz-porphyry at Teall Point, on the west shore of Doobaunt Lake. A similar massive quartz-porphyry forms a heavy east-and-west dyke some distance further north on the shore of the same lake, and in the vicinity of the dyke the surrounding conglomerate is very much hardened, so that it breaks indifferently through the matrix or through the pebbles. In places the porphyry contains little or no quartz.

Towards the north end of Doobaunt Lake, the orthoclase of the porphyry is replaced by plagioclase, thus forming an andesite or dacite. This andesite is largely developed, and seems to underlie a large tract of country, along the Doobaunt River between Lady Marjorie Lake and the Forks, and again it was found on the islands towards the east end of Baker Lake.

Basic eruptives.

Dark-green basic eruptive rocks, chiefly, or perhaps exclusively, in the form of dykes, are more or less extensively developed throughout the area covered by the Athabasca series, often altering these rocks into a quartzite or quartzitic conglomerate.

On Doobaunt Lake, and on the Doobaunt River near the Forks, most of these dykes are of more or less typical diabase, showing ophitic structure, with interlocking lath-shaped crystals of plagioclase, between which are crystals or crystalline masses of augite, often altered to chlorite. Apatite and iron ore are also usually present.

The heavy dyke, cutting the conglomerate at the gorge above Grant Lake, has a much newer appearance, being composed of a dark pitchstone with glassy matrix, through which are scattered many minute feathers of iron ore.

The heavy diabase dyke, crossing the Telzoa River at Loudon Rapids, cuts the surrounding acid eruptive rocks, and is clearly newer than them. In most cases, however, the acid and basic eruptive rocks were not seen in contact, and their relative ages were not determined; but since the latter are also common in the Huronian and Laurentian, it would seem probable that some are older, and some are newer than the acid eruptives.

Absence of fossils.

Though fossils were carefully looked for in the Athabasca sandstones, none could be found, so that the age of this formation must be determined on stratigraphical and lithological grounds alone.

Stratigraphical position.

That they are separated from quartzites of the Huronian by a great unconformity, is shown by the fact that the conglomerates are composed largely of rounded and waterworn pebbles of these quartzites,

which had therefore been altered, hardened and recemented with interstitial silica, before they were broken down by meteoric agencies, and carried out into the water off the shore to form the later conglomerates. They are also certainly older than the flat-lying Cambro-Silurian limestones which were seen on Nicholson Lake, for, though the two were not seen in contact, pebbles and boulders of Trenton limestones were found in many places, evidently derived from other outliers of the limestone than the one seen, and none of them showed any signs of alteration from contact with the numerous trap flows that cut the sandstone and conglomerate. Therefore, since they hold a position unconformably above the Huronian and below the Cambro-Silurian, they may be assigned with probability to the Cambrian. Lithologically the whole terrane presents a remarkable resemblance to the red sandstones and Cambrian quartz-porphyrries of the Keweenaw rocks of Lake Superior. This resemblance is so strongly marked that small specimens of rocks from the shore of Doobaunt Lake, are usually indistinguishable from specimens from Lake Superior. The two terranes are regarded as holding similar positions in the geological time-scale.

The Athabasca series was first met with during the explorations here reported on at Teall Point, on the west side of Doobaunt Lake, and thence it was found to underlie many of the islands and more prominent points along the west and north shores of the lake, to its outlet. Whether it extends eastward to, or beyond, the east shore of the lake was not determined, but it is not improbable that the lake lies in a basin underlain by these rocks.

From the north end of Doobaunt Lake, northward to the Forks of Doobaunt River, the sandstones and traps occur at intervals, overlying the Laurentian granites and gneisses. From the Forks the Athabasca series extends eastward, along both shores of Aberdeen Lake and on the south shores of Schultz and Baker lakes, as far as Bowell Island, a total distance of 180 miles. Whether it continues farther eastward was not determined. These rocks were not observed on Kazan River, as far as this stream was descended, but below Yath-kyed Lake many boulders of red sandstone and quartz-porphry were scattered about, and the till had quite a reddish colour, as if it had been derived from these rocks.

Toward the west, the Athabasca series probably extends a long distance up the valley of the Thelew River, and may perhaps cross the low watershed and connect with the similar rocks on the shores of Great Slave Lake.* The reported existence of low flat country, through

* Note to accompany a Geological Map of the Northern (N.S.) Portion of Canada, by George M. Dawson, Annual Report Geol. Surv. Can., vol. V., 1886, p. 16 R.

which there is a passable canoe-route from Great Slave Lake, to the Forks, would favour the assumption that the region is underlain by these flat-lying sandstones. It is not improbable also that the Athabasca series continues north-westward, and is directly connected with the Cambrian sandstone, traps and quartz-porphyrries (!) on the Coppermine River, from which the Indians have, for ages, obtained a supply of native copper.*

The sandstones of the Athabasca series, which occur in the south-west corner of the accompanying map-sheet, and which extend into the large region south and east of Lake Athabasca, have already been described by the author in his "Report on the Country between Athabasca Lake and Churchill River." They are there very similar in character to the beds further north, and in fact, it is quite possible that the two areas may be connected down the valley of Slave River, and through the valley of Great Slave Lake.

Churchill
arkose sand-
stone.

The Churchill arkose sandstone is also placed provisionally in the Cambrian, though its exact position is still somewhat uncertain. It consists of a highly felspathic quartzite, very much hardened, and tilted at various angles. It is thick-bedded, and often shows false-bedding. The grains are moderately well-rounded and rather even, but a few of the beds contain well-rounded pebbles, up to the size of one's fist, of white quartzite like that of the Huronian of Marble Island. It is also cut by occasional veins of white quartz.

The rock is very much more altered than most of the sandstone of the Athabasca series, but it resembles it in containing pebbles of the white quartzite, and it lies unconformably below the Cambro-Silurian limestones.

CAMBRO-SILURIAN.

The only representatives of rocks of this age found within the area of the accompanying map, are two small outliers; one on an island near the north end of Nicholson Lake, and the other just north of the mission at Churchill.

Nicholson
Lake outlier.

The exposure in Nicholson Lake occurs for 130 paces along the shore of a small low island. It consists of a few feet of white limestone in regular beds, slightly tilted so that it dips at a low angle towards the west. Fossils seemed to be scarce and poorly preserved, but the few that were found indicate that it is of about the age of the Trenton of Eastern Canada.

* *Loc. cit.* p. 28 R., *et seq.*

The only determinable species found are enumerated on pp. 55 and 56.

Other areas of similar limestone doubtless also occur in the vicinity, for a few boulders of white limestone were found on the surface at various points north of Barlow Lake, but none of these areas were located.

The Churchill outlier consisted of a few square feet of yellowish compact limestone in the bottom of a fissure, along a line of bedding in the Churchill arkose. It was composed largely of three species of corals, which seemed to be in the same position in which they originally grew on the surface of the arkose. Associated with the corals were broken fragments of shells of *Orthoceratites*, etc. The occurrence was so small that it was almost entirely worked out by the writer. The rock was very similar to the Trenton limestone of Manitoba, and the fossils collected from it and enumerated on page 91, would indicate a horizon near the upper part of that series.

Churchill outlier.

Besides the small exposure of Trenton limestone found in place, many angular fragments of similar limestone are scattered along the beach, showing the presence of larger areas in the vicinity.

The only other outcrops of Trenton limestone, etc., examined during the seasons of 1893 and 1894 were on the shores of Pine Island, Sturgeon and Beaver lakes. These will be found described on page 101.

SILURIAN.

Silurian rocks in place were not seen during the course of the two explorations here treated of. But masses of white limestone are scattered along the river bank near Churchill, having evidently been derived from some parent beds near at hand.

Loose masses near Churchill.

The limestone is very similar to that found at the mouth of the Saskatchewan River, and four at least, out of the five species of fossils here collected and enumerated on page 91, are common to these two localities, and three of them have, as yet, not been found elsewhere.

PLEISTOCENE.

There is probably no part of North America to which the student of glacial geology looks with greater interest than to the region lying north-west of Hudson Bay, for, during a part, or perhaps during the whole, of the glacial period, there here existed a great *névé* or "gathering ground," from which the ice flowed outward in all directions.

* See Report on North-western Manitoba, by J. B. Tyrrell, pp. 202 E and 203 E. Ann. Rep. G.S.C., vol. V. (N.S.) 1890-91.

Keewatin
glacier.

The vast glacier thus formed has been called by the writer the Keewatin Glacier, from the Cree Indian word *Kī-wē-tin*, which means north, or north wind, and the name is considered appropriate, not only because the gathering ground lay partly within the district of Keewatin, but also because it was the most northern of three great centres of glaciation—the Cordilleran, the Keewatin and the Labradorean.

Intermediate
in time and
position.

Previous observations have shown* that the Keewatin glacier was intermediate in time, as in position, between the first and last of those above-named. But, unlike them, the centre, from which its ice flowed outwards in all directions, was situated on a wide and moderately level plain, which is now from 400 to 800 feet only above sea-level and slopes seaward from higher land towards the south-west. Whether this plain was higher during any part of the glacial epoch than it is at present, has not as yet been determined, but no satisfactory evidence of such elevation has been found.

At the close of the glacial period the land here stood several hundred feet below its present level, as is shown by the old beaches which rise one above another to heights of from 500 to 600 feet above sea-level on the maritime plain west of Hudson Bay.

Absence of
evidence of
high elevation
of the land.

As may be seen by reference to the accompanying sketch-map, the centre (or centres) of ice distribution was situated close to the sea. If the Arctic Sea and Hudson Bay were open, as they are at present, they would have furnished a supply of moisture which, in the prevailing low temperature of that epoch, would have been precipitated as snow on the adjoining land. The snow would have gradually accumulated to a great depth, and would thence have spread outwards with a long easy slope towards the interior of the continent, and a more rapid descent towards the sea-coast. This would agree with all the phenomena observed, and appears to the writer to represent the conditions that obtained here in glacial times. A general rise of the land of 700 feet above its present level, would have drained Hudson Bay, and would have carried the water a long distance from the present Arctic coast. If these conditions had prevailed, it is exceedingly difficult to understand whence the moisture could have been derived to form the vast accumulation of ice which, apparently, covered the interior plains of the north from the State of Iowa northward to the Arctic Ocean.

* Glacial Deposits of South-western Alberta, by G. M. Dawson. Bull. Geol. Soc. Am., vol. VII., pp. 31-66, 1895.

The Genesis of Lake Agassiz, by J. Burr Tyrrell. Journ. of Geol., vol. IV., No. 7, 1896, pp. 811-815.

If the land was not higher than it is at present, the ice must have accumulated to a great thickness to enable it to move southward and south-westward over the gradually ascending country, but that the ice of the glacial period did ascend to very considerable heights, has been shown by many observers. Nowhere is this ascent more conclusively seen than on the Duck Mountains in Northern Manitoba. These are high hills of Cretaceous shales and sandstones rising from 1000 to 1600 feet above the low and moderately level country towards the north and north-east, which is underlain by Archean and Palaeozoic rocks. The summits of these hills are morainic accumulations, composed largely of boulders which have been derived from the older rocks of the low country, and which have been raised to their present position by the Keewatin glacier as it moved upwards from the north.

Upward
movement of
the ice.

The whole of the northern country near the centres from which the Keewatin glacier was distributed, is composed of a vast irregular plain of till, through which rise rocky knolls, formed largely of more or less angular fragments of local rock. Some of these knolls are very much fractured, and often a whole hill seems to consist exclusively of broken angular masses of rock, the underlying, unbroken rock being entirely hidden from view. The contrast between the scraped and bare rock-surfaces further south, as in the vicinity of Reindeer Lake, and the undecayed, but broken and debris-covered surfaces in the north, is very marked.

Striae.

As is shown on the accompanying map, most of the glacial striae between Lake Athabasca and Doobaunt Lake point in a west-south-westerly, or westerly direction, but on Doobaunt Lake, and on the upper portion of the Telzoa River, there is an earlier set pointing southward. Between Doobaunt and Baker lakes the later striae gradually swing round towards the north-west. Further east, on the course from Cumberland House, on the Saskatchewan River, to Kasba Lake, the striae all point a little west of south, and no evidence could be found that at any time during the glacial period did the glacier move in any direction but that indicated by these striae.

General
direction

On the rocks of the coast north of Churchill, all the striae point more or less directly down into Hudson Bay, and the smoothly rounded landward slopes, the craggy broken cliffs facing seaward, the crescentic cross-fractures and boulder-trains, all show that the ice flowed towards Hudson Bay, and furnish strong evidence that it never moved in an opposite direction. The evidence collected in 1893 in regard to this eastward flow of the ice, was confirmed and strength-

ened by the additional facts obtained on portions of the same coast in 1894.

Possible
exception.

The only observation which is at variance with this general result is the existence of an early set of striae, pointing westward, on the rocks at Churchill. Whether these striae were made by a glacier flowing from a centre near at hand, or at a distance, was not determined. They do not accord with the striae attributed to the Labradorean glacier along Nelson River and further south, for while the west-pointing striae at Churchill were earlier than those of the Keewatin glacier, those of the Nelson River and further south are clearly later.

Rounded hills
at Churchill.

The rocky hills at Churchill are well rounded on almost every side, having been planed by glaciers moving in turn from the east, the south-west and the north. Even a casual observer could not but recognize the difference between these hills and the broken rocky elevations further north, with their strongly marked stoss and lee sides, nowhere showing any evidence of a glacier having approached or over-ridden them from the seaward side.

These seaward-pointing striae may be seen on most of the rocks on Ferguson River, and on the shores of Chesterfield Inlet as far up as Baker Lake, at which place they overlie, and intersect the striae pointing north-westward.

On the shores of Yath-kyed Lake, and on the banks of Kazan River upwards to Angikūni Lake, the main direction of striation is south-eastward, but there is a later, and apparently local, set pointing north-westward.

Observations around Great Slave Lake, down Back River and along the Arctic shore, as well as in the country between Cochrane and Kazan rivers and the west coast of Hudson Bay, are greatly needed to supplement the observations taken in this interior northern country. The information which we have attempted to set down in the present report, and to briefly outline here, seems to indicate clearly the following stages in the growth and decline of the Keewatin glacier:—

Three stages
in the growth
and decline of
the Keewatin
glacier.

1st. A centre north-west or north of Doobaunt Lake, probably between the Telzoa and Back rivers, from which the ice flowed southward, at least as far as north latitude 60° , though it may have extended over the Great Plains, and have there formed the lower boulder-clay. It no doubt also spread outwards from the centre in other directions.

2nd. As the ice increased in thickness, and perhaps after a warmer period, the centre of distribution moved south-eastward until it rested

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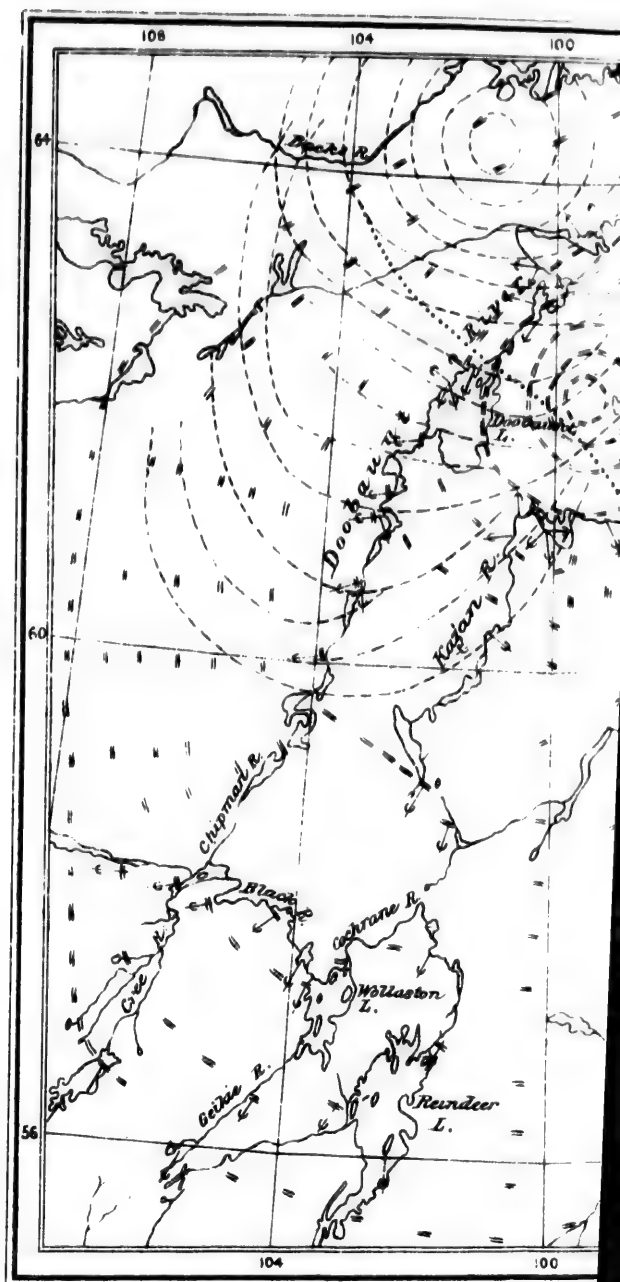
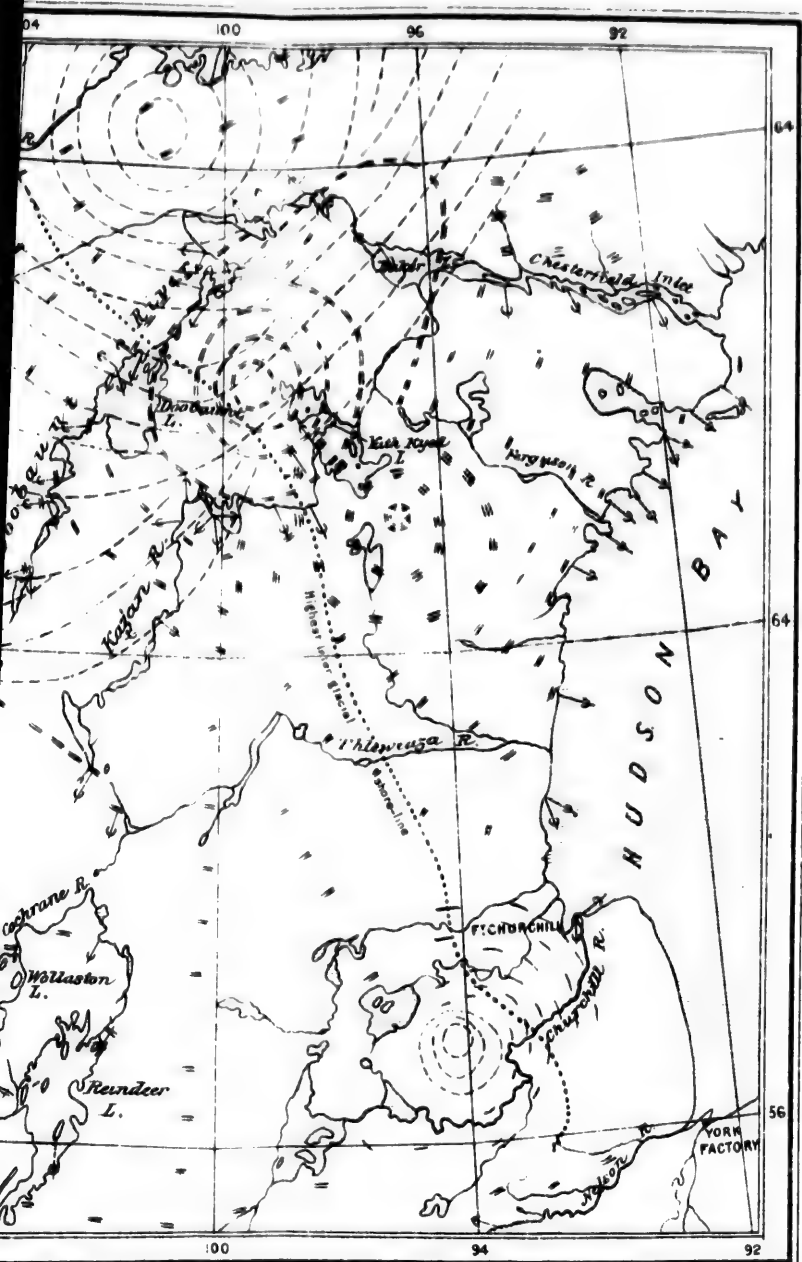


Diagram
showing three positions succe
Centre of the Keew

Geological Survey of Canada

GEORGE M. DAWSON CMG LL.D. F.R.S. DIRECTOR

1897



Diagram

showing three positions successively occupied by the
Centre of the Keewatin Glacier

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over the country that is now almost surrounded by the Doobaunt and Kazan rivers below Doobaunt and Angikūni lakes. At this point the ice must have been of great thickness, for it flowed outwards in all directions, reaching, in the writer's opinion, to within a short distance of the base of the Rocky Mountains on the west and far into Minnesota, Dakota and Iowa on the south.

3rd. When the Keewatin glacier had greatly diminished in size, the centre of distribution moved still nearer to the sea-shore, and probably broke into several distinct glaciers. One of these was situated on the hills south-east of Yath-kyed Lake, while another seems to have been located north of Baker Lake.

The following is a list of the glacial striae observed in 1893 and 1894, with the exception of those recorded in my previous report on the country between Athabasca Lake and Churchill River :—

List of striae.

List of Glacial Striae.

	Direction.
Athabasca River :—	
Cascade Rapid.....	W.
Chipman River :—	
North end of Portage from Black Lake.....	S. 45° W.
Telzoa River :—	
Daly Lake, north side of Narrows.....	S. 80° W.
(1st set) S. 60° W.	
" latitude 60°.....	S. 85° W.
" island in northern expansion.....	S. 70° W.
(1st set) S. 25° W.	
" island two miles east of above island.....	S. 73° W.
" island near north-east end.....	S. 75° W.
" near north end.....	S. 75° W.
Hinde Lake, west shore.....	S. 80° W.
Midway between Boyd and Barlow lakes.....	S. 5° E.
Five miles above Barlow Lake.....	S. 80° W.
Barlow Lake, near south end.....	S. 80° W.
Cairn Point in Carey Lake.....	S. 85° W.
Carey Lake, four miles from its outlet.....	S. 85° W.
Carey Lake, outlet.....	S. 80° W.
(1st set) S. 20° E.	
Four miles below the outlet of Carey Lake.....	S. 85° W.
Two miles below the last.....	S. 88° W.
(1st set) S. 20° E.	
Markham Lake, west shore.....	S. 86° W.
Doobaunt Lake, at mouth of Telzoa River.....	S. 87° W.
" " five miles farther north.....	N. 80° W.
" " mouth of Sunset Creek.....	N. 80° W.
(1st set) S. 30° W.	
" " two miles east of north-west angle.....	S. 20° W.

Doobaunt Lake, north-west angle.....	(3rd set) N. 50° W.
	(2nd set) S. 20° E.
	(1st set) S. 20° W.
" " north shore.....	N. 50° W.
" " " " two miles S. E. of last (3rd set) N. 40° W.	
	(2nd set) N. 60° W.
	(1st set) S. 23° W.
" " point at Narrows, 3 miles farther east.....	N. 35° W.
Wharton Lake, quartzite hill.....	(2nd set) N. 70° W.
	(1st set) S. 33° W.
Lady Marjorie Lake, east shore.....	N. 60° W.
Nine miles below Lady Marjorie Lake.....	(2nd set) N. 85° W.
	(1st set) S. 25° W.
Aberdeen Lake, north shore.....	N. 35° W.
Between Aberdeen and Schultz Lakes.....	N. 28° W.
Schultz Lake, east end.....	N. 47° W.
Nine miles below Schultz Lake.....	N. 47° W.
Eight miles above Baker Lake.....	N. 50° W.
Baker Lake, mouth of Prince River.....	(2nd set) S. 29° E.
	(1st set) N. 54° W.
" " nine miles east of Prince River.....	S.
" " bay east of Stone Tower.....	S. 13° W.
Chesterfield Inlet:—	
Mouth of Telzoo River.....	(3rd set) S. 43° E.
	(general) (2nd set) S. 3° E.
	(1st set) S. 65° W.
Island off Flat Point.....	S. 17° W.
Seven miles west of Bold Point.....	S. 23° E.
Four " " ".....	S. 23° E.
Low Point.....	S. 17° E.
North shore in east longitude 93°.....	S. 17° E.
One mile east of Dangerous Point.....	S. 20° E.
Small island opposite Poston Point.....	S. 50° E.
Observation Point.....	S. 86° E.
Sturgeon River:—	
East side of Sturgeon Lake.....	S. 20° W.
Red Rock Portage.....	S. 25° W.
Island in Beaver Lake.....	S. 20° W.
Above Snake Portage.....	S. 10° W.
Leaf Portage.....	S. 15° W.
Birch Portage.....	S. 15° W.
Dog Portage.....	S. 10° E.
Portage above Pelican Lake.....	S. 25° W.
Pot-hole Portage.....	(2nd set) S. 30° W.
	(1st set) S. 15° W.
Reindeer River:—	
White Sand Falls.....	S. 17° W.
Rock Portage.....	S. 17° W.
Cochrane River:—	
Seven miles above Reindeer Lake.....	S. 35° W.
Eight " " ".....	S. 30° W.
Latitude 58° 22' 45".....	S. 30° W.
Island in latitude 58° 26' 30".....	S. 13° W.
Island in Du Brochet Lake.....	S. 28° W.

Thlewiaza River:—

Granite hill beside Thebayazie River.....	S. 18° W.
Near source of " "	S. 28° W.

Kazan River:—

Hill south-east of Kasba Lake.....	S. 30° W.
North-east side of Ennadai Lake.....	S. 40° W.
Hill below " "	(2nd set) S. 50° W.
	(1st set) S. 65° E.

Eiyegiak	S. 80° W.
Angikūni Lake, west end of	(2nd set) N. 5° E.
	(1st set) S. 75° W.

" " Enetah	S. 57° E.
" " island.....	(3rd set) N. 30° W.
	(2nd set) S. 50° W.
	(1st set) S. 5° E.

" " island north of last	(4th set) N. 30° W.
	(3rd set) S. 50° W.
	(2nd set) S. 5° E.
	(1st set) S. 85° E.

" " Granite Point near north end.....	S. 80° E.
Pasamut's Falls.....	S. 25° E.
Ten miles below Aūna.....	S. 25° E.

Pallel-lua.....	N. 35° W.
Yath-kyed Lake, Island in	N. 35° W.
" " point on west shore.....	N. 30° W.
	(1st set) S. 60° E.

" " point north of last	N. 33° W.
" near north-west angle	N. 35° W.
	(1st set) S. 60° E.

Below Yath-kyed Lake.....	S. 55° E.
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Ferguson River:—

Ferguson Lake, north shore	S. 50° E.
" " south shore.....	S. 45° E.
Lake above Kaminuriak Lake	S. 53° E.
	(1st set) S. 16° E.

Rapid above Kaminuriak Lake	S. 40° E.
Portage below " "	S. 25° E.
Above Quartzite Lake.....	S. 15° E.
Quartzite Lake	S. 25° E.
400 yards portage below Quartzite Lake.....	(2nd set) S. 17° E.
	(1st set) S. 60° E.

Lowest portage	S. 35° E.
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Nelson River:—

Gull Lake.....	N. 76° W.
Seepiwisk Lake.....	S. 68° W.

Hudson Bay shore:—

Mouth of Chesterfield Inlet	S. 55° E.
Opposite Fairway Island	S. 55° E.
Baker's Foreland	S. 50° E.
North of Rabbit Island	S. 21° E.
North shore of Ranken Inlet	S. 48° E.
Island in mouth of Ranken Inlet	S. 70° E.
	(1st set) S. 38° E.

Cape Jones	S. 65° E.
	(1st set) S. 15° E.

Point south of Corbett Inlet	S. 67° E.
North shore of Pistol Bay	S. 55° E.
Island in Pistol Bay	S. 53° E.
Whale Cove	S. 38° E.
Island in Mistake Bay	S. 42° E.
West shore of Mistake Bay	S. 42° E.
North shore of Dawson Inlet	S. 50° E.
Ten miles south-west of Wallace River	S. 60° E.
Latitude 60° 34'	S. 70° E.
Six miles south of Egg Island	S. 15° E.
Ten " " "	S. 60° E.
Churchill	(3rd set) S.
	(2nd set) N. 50° E.
	(1st set) S. 80° W.

Till.

Whitish till. The country from the "Pas" ridge, on the Saskatchewan River, to Beaver Lake, on Sturgeon River, is all more or less thickly underlain by a whitish stony till, consisting of a calcareous silt or rock-flour mixed with striated boulders of Palæozoic limestone, gneiss, hornblende-schist, etc.

Less abundant over the Archaean rocks. North of Beaver Lake is a rocky country, where, as a rule, the stony till merely fills the depressions between the ridges of Laurentian granite and gneiss. This country, which is generally covered with a dense coniferous forest, extends as far northward as Reindeer Lake, north of which, to the north end of Reindeer Lake, the country consists of almost unwooded rocky hills and ridges,

Boulders numerous. At the north end of Reindeer Lake, boulders again become very abundant, and thence northward to Schultz Lake the whole country is covered with a mantle of drift, consisting chiefly of boulders and apparently unstratified silt or rock-flour. Natural sections of these drift deposits are very scarce, for the ice protects the banks of the lakes and streams from the waves and currents, by piling against them compact walls of boulders, which resist eroding agencies almost as effectually as the solid rock itself. Vegetation is, however, rather scanty, and the clay surface is almost everywhere more or less exposed to view. The presence of boulders is a very dominant feature, and there may be barely sufficient rock-flour to fill the interspaces and bind the whole into a compact mass. In some places the silty matrix is absent and the surface then consists of a loose mass of boulders or rock fragments.

Undulating surface. The surface of this till-covered country is usually gently undulating. Here and there these undulations rise into high regular drumlinoid hills, like those on the lower portion of Cochrane River, or into low drumlins like those south of Boyd Lake on Telzoa River, near Uliū on Kazan River, etc.

On the lower portion of Ferguson River many of the rocky hills are free from drift, and the extensive areas of broken angular rock-fragments are much less common than further west. The intervening plains between the rocky hills are, however, still thickly drift-covered. The rounded rocky shores of Chesterfield Inlet are remarkably bare and free from drift, but how far back from the shore this bare rocky country extends was not determined.

The shore of Hudson Bay almost everywhere gave evidence of a thick deposit of drift. North of Wallace River, where the contour of the rocky surface would seem to be rather pronounced, the summits of the rocky hills are bare, but the depressions are filled with till, and shallow points of bouldery till extend seaward for long distances. South of Wallace River the rock surface is probably much more even, and the till-covered country extends as a more or less regular slope down under the water of the bay.

The evidence furnished by the distribution of the drift, adds weight to the conclusions deduced from the observations on glacial striae as to the direction and extent of the movements of the Keewatin glacier.

Shore of
Hudson Bay.

Direction of
transportation
of boulders.

On the route from Reindeer to Theitaga lakes, the boulders seemed to consist exclusively of gneiss and other Laurentian rocks. As Kasba Lake is approached from the south, boulders of Huronian rocks become abundant—derived from the Huronian trough in the vicinity of that lake.

At the south end of Ennadai Lake, we found the first evidence of the transportation of material from the far north, in rounded pebbles of red sandstone and quartz-porphry, similar to the Cambrian rocks that extend across the country from Doobaunt Lake to Baker Lake. At the north end of Daly Lake, and just beyond the north end of Ennadai Lake, striae of the early glacier from the north and north-west were seen for the first time. From Ennadai Lake northward, boulders of Cambrian rocks became somewhat more common, until, between Angikūni Lake and the north point reached on Kazan River, the till is of a brick-red colour, on account of having been derived largely from these red Cambrian rocks.

On Ferguson River, boulders of red Cambrian rocks were also found all the way down to the shore of Hudson Bay, but no evidence could be found to show that the diabase rocks of the shore of Hudson Bay had ever been transported inland, though any traces of such evidence were carefully sought for.

Fragments of red Cambrian rocks were found all along the shore of Hudson Bay, diminishing in size and number to a few pebbles at

Churchill. With these were also a very few pebbles of white Paleozoic limestone, probably derived from outliers of Paleozoic rocks similar to the one on Nicholson Lake. Some of these pebbles have doubtless been carried from place to place along the shore by floating ice, for, in the autumn of 1893, we often saw pebbles and cobbles frozen in cakes of ice, and being carried along by them.

Moraines.

Common throughout the country.

Many rough stony ridges were observed at various places throughout this whole northern region, crossing, or extending beside, the lines of travel. Some of them were undoubtedly terminal moraines dumped at the foot of the Keewatin glacier, as it halted from time to time in its gradual recession towards the north. As a rule they are very irregular in contour, but lie roughly transverse to the general direction of striae on the rocks beneath.

Between Saskatchewan and Churchill rivers.

The prominent morainic ridge, which was crossed in 1892 between Prince Albert and Green Lake, was again crossed in 1893 north of Vermilion River, on the trail from Edmonton to Athabasca Landing.

On Chipman River.

On Chipman River, between Chipman and Birch lakes, a rough stony morainic ridge crosses the river and blocks up the valley at the longest of the three portages. It consists of boulders of the surrounding Laurentian rock, imbedded in a gray rock-flour.

Along Telzoa River.

Near the south end of Boyd Lake, a rough stony morainic ridge runs S. 20° E., almost at right angles to the last set of glacial striae in the vicinity, and to the long esker which there crosses the country.

Thence northward for seventy miles, to the north end of Carey Lake, the country often presents an exceedingly stony morainic appearance, though this is more particularly the case near the outlets of the lakes than elsewhere. For example, heavy morainic ridges cross the country at the north ends of both Barlow and Carey lakes.

Below Doobaunt Lake the moraines are obscured or modified by the more recent marine deposits. However, below Grant Lake, and along the west shore of Wharton Lake, there is an irregular stony ridge which would appear to have been a moraine, and the rough stony hills between Wharton and Lady Marjorie lakes are undoubtedly morainic.

Below the Forks of Doobaunt River no well defined moraines were recognized.

The "Pas."

The ridge on the Saskatchewan River at the "Pas," which is probably continuous with the ridge north of Lake Winnipegosis, is a moraine of the Keewatin glacier deposited after that glacier had

retreated northwards from the lowlands of Manitoba, and probably before Lake Agassiz had been formed by the union of the fronts of the Labradorean glacier from the east and the Keewatin glacier from the north.

An accumulation of till and boulders, probably morainic in character, skirts the south side of Churchill River in the vicinity of Frog Portage. ^{Near Frog Portage.} It seems to have blocked up the channel of the early glacial stream that once flowed southward across the Lake of the Woods, and to have formed the large pot-holes at Pot-hole Portage.

The rounded stony hills, a few miles north of the north end of Reindeer Lake, almost undoubtedly represent another great moraine, ^{On Cochrane River.} possibly smoothed and compacted by a slight re-advance of the glacier.

The next well-defined moraine is just north of the northern bend of Cochrane River, whose waters are diverted southward by a tract of very rough stony hills, resting on a northerly slope. North of this moraine lies Blue Lake, whose waters drain northward to the Thlewiaza River.

Kasba Lake lies on the summit of a steep slope, and the low sandy hills near its outlet are almost undoubtedly morainic in character. ^{On Kazan River.}

Ennadai is also dammed back by a wide ridge of rough morainic hills, through which the Kazan River winds in an irregular and often broken channel.

Some of the stony hills around Angikūni and Yath-kyed lakes are undoubtedly morainic, but the rainy and stormy weather, and the necessity of constant travel, did not permit of their examination.

The hilly ridge between Kazan River and the head of Ferguson River is also probably morainic, though much finer material enters into the composition of the moraine here than is often the case elsewhere.

A well-defined ridge of stony morainic hills, considerably modified by subsequent wave action, runs parallel to the shore of Hudson Bay near the mouth of the Ferguson River. ^{On Ferguson River.} Our last camp on this river was pitched in the snow at the foot of one of the prominent knolls on this ridge.

The shore of Hudson Bay north of Cape Esquimaux consists of high morainic hills and ridges of large boulders, giving the country a very rough sterile appearance, and again the lower boulder hills and ridges along the shore between north latitudes 59° and 60° are undoubtedly portions of a moraine of the glacier that flowed from the west downwards into the basin of Hudson Bay. ^{On Hudson Bay shore.}

On the overland journey from Churchill to Norway House no moraines could be definitely recognized, but it is not at all unlikely that some of the hills near the headwaters of Owl River are of morainic origin.

Many more moraines than those here mentioned undoubtedly cross this great region, but these were the ones most clearly recognized from, the line of travel.

Eskers.

Conspicuous objects. Eskers form some of the most conspicuous objects in the landscapes of the far north, where they rise in steeply sloping ovoidal hills, high above the surrounding plains, or extend in long narrow ridges, keeping their direct courses across hills and valleys alike, without regard to pre-existing surface slope or contour.

General character. They occasionally rise to heights of from two to three hundred feet and are usually composed of well-rounded sand and gravel, though their summits may often be sprinkled with boulders. As a rule, the esker consists of a single ridge with steeply sloping sides, or perhaps with one or two low subsidiary ridges. But occasionally the single ridge is replaced by several high parallel ridges, between which are deep intervening depressions, often without outlet. In most, if not in all cases, these eskers would appear to have been deposited on the ground by running water in the beds of streams that flowed in icy valleys in gorges between walls of ice or in tunnels under the ice. Where the chasm or tunnel has been fairly persistent for a long time, the sand and gravel has been deposited evenly, and as the ice melted away from both sides a straight uniform ridge has been formed. But where the chasm or tunnel has been broken by huge masses of ice falling into it, the gravel and sand were deposited in several channels, and as the ice melted away these have formed parallel but often coalescing ridges.

Mode of formation. That these eskers have usually been deposited on the ground, and not on a bed of ice in the bottom of the icy channel, would appear to be almost conclusively shown by the fact that most of them consist of a single main ridge, the middle line and crest of which does not seem to have been disturbed or broken since it was first deposited. If the gravel and sand had been deposited over a bed of ice, then, as the ice on both sides melted away, the sediment would have slid down to both sides of the central icy ridge, and two parallel ridges of gravel and sand would have been formed which would have been at varying distances from each other according to the height of the icy bed on which

the sediment had been deposited. As the heights of these double ridges would depend on the amount of gravel, etc., at any one place in the original channel, they would rise and fall in keeping with the width, etc., of that channel, irrespective of the ground over which they are now running, instead of which the eskers usually have very smooth even crests, and they are almost always much higher over the lowlands than over the hills, thus tending to such an even surface as would have been formed by a running stream.

The conspicuous esker on the west shore of Hinde Lake, also presents strong confirmatory evidence pointing in the same direction. Red Hill is the south-western terminus of this esker, where the stream that formed it appears to have reached the edge of the ice sheet, and there to have built up a small fan-shaped delta. At the end of the esker is a steep slope of rounded gravel, which has remained almost undisturbed since it was deposited in the water that skirted the face of the glacier, and the two old beaches on this gravel slope are almost as fresh as if they had been formed yesterday. From the summit of this gravel slope, the esker extends at almost the same height north-eastward, as a long regular ridge, that has evidently remained unbroken since it was originally formed.

The shores of Selwyn Lake are largely composed of boulders and unsorted drift, perhaps morainic. With the hills of boulders are some long sandy eskers, running parallel to the glacial striæ, and some sandy islands, which may be broken eskers, or may represent small deltas formed at the mouths of superglacial streams, in the beds of which there had been no deposits of sand or gravel.

An esker, south of the narrows of Daly Lake, is a very pretty grass-covered sandy ridge, running S. 40° W. from some stony hills near the shore. Winding slightly, it rises over some rocky knolls seventy feet above the lake and thence continues an unknown distance inland. On Telzoa River.

Another esker, from fifty to seventy feet high, runs N. 75° E. as a single, or divided, sandy ridge, from the east bank of the river a short distance below Daly Lake.

Red Hill, on the west shore of Hinde Lake, is the south-western terminus of a long esker which extends an unknown distance towards the north-east. As stated above, its termination is marked by a steep bank of rounded water-worn gravel, while the ridge itself is here composed of several elongated overlapping sandy hills, 120 feet high, between which are deep depressions without outlet. The hill dips slightly towards the north-east, and thence continues as a long straight sandy ridge, through which the Telzoa River cuts, a short distance

below Ptarmigan Rapid. This esker is clearly marked as it crosses the thinly wooded country, on account of being covered with fine tall white spruce.

A similar parallel sandy ridge, which may be designated Whitespruce Esker, crosses the river a few miles further north. Where it is cut through by the river, it has a height of twenty-five feet.

Another esker, running N. 70° E., and S. 70° W., crosses the south end of Boyd Lake, forming a chain of islands across the lake, and a long straight ridge on either shore.

Some high sandy hills on the north shore of Doobaunt Lake may have formed part of a broken esker, but these are more probably ispatinows, such as are seen so well developed around Cree and Black lakes, and have been described by the author in his Report on the country between Athabasca Lake and Churchill River.

On Churchill River.

The first eskers seen in 1894 were on the north bank of the Churchill River, a short distance below Frog Portage. They consist of three oval pointed hills of stratified sand, rising to heights of sixty feet above the river, and trend S. 25° W., parallel to the glacial striae on the surrounding rocks.

On Reindeer River.

The esker extending northward from White Sand Portage is much longer than those on Churchill River, but it is not impossible that it was formed by the same great glacial stream. The Indians, who resort to the banks of Burntwood River to trade, report that this esker can be followed for a long distance into the country towards the north-east.

On Cochrane River.

A magnificent esker was seen near Cochrane River. It consists of a long ridge of sand and fine gravel thinly wooded with large Banksian pine and white spruce. In some places, as where the river cuts through it, it is steep and narrow, but in other parts it is much wider, and is broken into little hills and ridges, giving it a very lumpy appearance. Its southern end was not seen, while towards the north it extends along the east bank of Cochrane River to the sandy plains south of the Blue Lake moraine. North of the moraine a similar sandy ridge, evidently formed in a continuation of the same drainage channel, runs along the west side of Blue Lake to Thanout Lake. The sand on the plains south of the moraine has undoubtedly been carried down from the north by a glacial stream and deposited as a fringe in front of the heavier morainic material, but the crest of the esker west of Blue Lake is lower than the level of the sand plain, and it is probable therefore that in this instance the sand of the esker was deposited in a stream with a bed, as well as with walls, of ice, and as the ice melted the sand slid into the ridges and hills that we now see.

Another narrow sandy esker forms the west bank of Thebayazie River for a short distance.

The high mammillated sandy ridge that crosses the middle of Kasba Lake is another fine example of an esker, which rises to a height of 180 feet above the lake. It was examined on the east side of the lake, but it extends across the lake in a direction S. 40° W., forming high sandy islands and another sandy ridge on the western shore.

On Kazan River.

A similar esker forms the west shore of the deep bay at the south end of Ennadai Lake, rising at its highest to between 200 and 300 feet above the water. This esker projects as a long sand and gravel point out into the lake. In the distance, on the west shore of Ennadai Lake another similar sandy ridge was seen.

Similar eskers were seen on Kazan River running in the same direction as the last glacial striation—one at Sandy Lake, another above Kopanuak's Camp and a third below Hallo Lake. Below this no eskers were seen, and it is probable that none were formed so near the centre of glaciation.

On the shore of Hudson Bay, Cape Esquimaux, and the point to the south, are also eskers considerably modified by subsequent wave action. They consist of straight narrow ridges several miles in length running S. 70° E., parallel to the direction of movement of the Keewatin glacier. Their surfaces consist entirely of sand and gravel, while the scarped face of a terrace twenty feet high on the former point, shows an unstratified sandy till full of boulders, overlain by stratified sand.

On the shore of Hudson Bay.

On the overland journey from Churchhill to Split Lake a lumpy sandy ridge, doubtless an esker, was seen north of Waségamow Lake, while a long and well defined esker was seen crossing the country in a direction S. 85° W and N. 85° E., between Mittitto River and Musogetaiwi Lake. On its south side are sand plains and hilly sand ridges.

Between Churchill and Nelson rivers.

Extra-glacial Lakes.

The country explored during the seasons of 1893 and 1894 is not characterized by the number or extent of its extra-glacial lakes.

Hyper-Black Lake extended northward up Chipman River as far as Chipman Lake, on the north side of which are some rather extensive sandy deposits, formed at the mouth of a glacial stream that flowed into that lake from the north.

Hyper-Black Lake.

Along the upper part of the Telzoa River, lake-shores are, as a rule, conspicuously absent, the only well-marked beaches seen being those on the south end of Red Hill, west of Hinde Lake. The extent of

the lake by which these were formed was not determined, and it is probable that it was very short-lived.

Hyper-Doo-
baunt Lake.

On the sides of some hills north of Doobaunt Lake, sandy terraces were seen at an elevation of 240 feet above the present level of the water of the lake, or about 740 feet above sea-level. These are considered to have been formed in an extra-glacial lake, which covered the country in the vicinity of Doobaunt Lake. In accordance with the nomenclature adopted in a previous report, this lake may here be called Hyper-Doobaunt Lake.

If lake deposits have existed in the country near the sea-shore, they have been obscured by the later marine deposits.

Lake Agassiz.

On the line explored in 1894, the terrace on the side of the Pas Ridge, thirty feet above the Saskatchewan River, and the gravel ridge, forty feet higher, undoubtedly represent two ancient shore-lines of Lake Agassiz when that body of water extended southward towards the foot of the Pasquia Hills.

At the north end of Beaver Lake, twenty feet above the present level of the water, is a gravel ridge representing an old shore-line, probably of an earlier and higher stage of the lake itself towards the close of the glacial epoch. Similar low-level terraces occur along some of the quieter reaches of the Sturgeon River, on Churchill River above Reindeer River, and around the south end of Reindeer Lake.

Hyper-Kasba
Lake.

An interesting series of ancient lake beaches occurs around the south end of Kasba Lake, clearly formed in an extra-glacial Hyper-Kasba Lake. Kasba Lake lies at an elevation of 1270 feet above the sea, and these beaches are respectively 50 150 and 200 feet above its surface. The highest one is rather weak and not very distinct, but the middle one is clear and well defined, but, though it is strong and distinct around the south end of the lake, I could see no signs of it on sides of the esker that crosses the middle of the lake. It is, therefore, probable that Hyper-Kasba Lake did not extend as far north as this esker, but that it lay at the foot of the Keewatin glacier shortly before the moraine was formed which now forms the stony ridges north-east of Kasba Lake.

No other lake deposits were recognized along the Kazan River north of Kasba Lake, though further exploration may prove that lakes did exist for short periods of time along the foot of the waning glacier or glaciers.

Marine Deposits.

Depression of
the land.

At the close of the glacial epoch, or rather, after the Keewatin glacier had retired from most of the country west of Hudson Bay, the land

stood several hundred feet below its present level, and the sea covered a wide belt of country which now slopes eastward or north-eastward towards Hudson Bay or the Arctic Ocean. The land then gradually rose, and the stages of its rise are marked by ancient beaches, terraces, sand-bars, etc. Dr. Robert Bell, of this Survey, believes that this elevation is still in progress around Hudson Bay*. Mr. A. P. Low has, however, adduced evidence to show that the land has ceased, or almost ceased, to rise around the southern portion of Hudson Bay†, and the writer, both in a previous part of this Report, and in a paper in the *American Journal of Science* for March, 1896, has expressed his belief that the land has reached a condition of comparative stability in the vicinity of Churchill.

In fact the conditions along the west coast of Hudson Bay are very similar to those in Labrador, in the valley of the Saint Lawrence, in the Maritime Provinces of Canada, and in the New England States, except that rock decay is very much less rapid in the northern than in the southern countries. Therefore the terraces, whether these are cut by the waves in the faces of the rocky hills, or are built along the shore, and the beaches of rounded gravel, are very much fresher in the northern country, and a geologist from the south might easily regard them as much younger than they really are.

On the Telzoa River, the highest abandoned sea-shores were seen in the vicinity of Grant Lake, a short distance below Doobaunt Lake. Grant Lake lies at an approximate elevation of 370 feet above the sea. Near its northern end is a sandy esker 270 feet high, the sides of which are particularly well suited to show any post-glacial shore-lines. Three terraces or old sea-beaches are well shown, the highest of which is 120 feet above Grant Lake, or 490 feet above the sea. As far as could be determined in the time at our disposal, this is the highest marine shore on the Telzoa River. If the above figures are correct, 490 feet would therefore represent the full extent of the rise of the land here since the close of the glacial epoch. The heights of Grant and other lakes are, however, only estimated, or determined by a few barometer readings, though they are probably correct to within a hundred feet.

Raised
beaches on
Telzoa River
near Grant
Lake.

At the Long Portage, near the west shore of Grant Lake, there is a distinct gravel beach seventy feet above the lake, or 440 feet above the sea.

* Proofs of the rising of the Land around Hudson Bay. *Am. Journ. Sci.*, vol. I., pp. 219-22. March, 1896. Report of Progress Geol. Surv. Can., 1877-78, pp. 25 C.C., and 33 C.

Ibid., 1878-79, p. 21 C.

† Report on Explorations in James Bay, by A. P. Low, *Annual Report Geol. Surv. Can.*, vol. III., 1887. Part J, pp. 32-33.

Hill east of
Wharton
Lake

On the sides of the conspicuous hill of Huronian quartzite on the east shore of Wharton Lake, three ancient sea-beaches are strongly marked, at elevations of 130, 105 and 60 feet above the lake, or 430, 405 and 360 feet above the sea, the upper one being formed of well-rounded coarse gravel and small cobbles, while the two lower ones are of fine gravel and coarse red sand.

Diabase hills
below Lady
Marjorie
Lake.

Corresponding beaches occur on the conspicuous hills of dark-green diabase below Lady Marjorie Lake, the highest of which is at an elevation of 440 feet above the sea, below which are four others, the lowest of which is at a height of 340 feet above the sea. On the south point of one of the hills these old shore-lines appear as five well cut notches, from which ridges of rounded gravel extend along the sides of the hill.

At the Forks, where the Doobaunt River is joined by the Thelew River, there is a wide sandy delta-plain, just below which is a sandy island 100 feet high, part of an ancient sand-bar, formed when the land stood about 260 feet below its present level.

Terraced hills
near Aber-
deen Lake.

Near the east end of Aberdeen Lake are some high well-terraced hills of conglomerate, on the sides of which a number of raised sea-beaches are particularly well marked. The highest beach (rather indistinct) is at the foot of a cliff 330 feet above the lake, or 460 feet above the sea. The next two are strong gravel beaches 300 and 230 feet above the lake, or 430 and 360 above the sea. The next 310 feet above the sea, is a terrace cut in the face of the hard conglomerate, with a beach of rounded gravel at its base. Below this are four other gravel terraces, respectively 280, 235 220 and 190 feet above the sea.

On a sandstone hill 400 feet high, at the east end of Schultz Lake the highest shore-line recognized was 260 feet up the hill, or 375 feet above sea-level.

A high beautifully terraced hill, similar to those just described, rises on the north side of Baker Lake just east of the mouth of Prince River, but it was impossible to spare the time for its examination.

The above figures would seem to indicate a moderately regular rise of the land in Post-glacial time, in that portion of the country extending from Doobaunt Lake eastward to the head of Baker Lake.

Terraces on
shore of
Hudson Bay.

The rocky shores of Chesterfield Inlet, and of the whole of the north-western coast of Hudson Bay north of Wallace River, are marked with gravel beaches, sandy terraces, etc., down to the present high tide level, but none of the hills on the shore are sufficiently high to show the higher terraces, and thus to determine the extent of the

elevation along the shore itself. Marble Island, which seems to rise high above the hills on the adjoining shore, would probably show all the higher beaches, but it has not yet been searched for such beaches.

On Kazan River, the higher marine shores were not so easily recognized as further west on the Telzou River, for high pointed hills, which form such conspicuous features on the banks of the latter stream, and on the sides of which the ancient shores were readily traced, are not present on the banks of the Kazan.

At Aūnah, near the northern bend of the river, extensive plains of stratified sand begin to make their appearance, and extend more or less continuously all the way to Yath-kyed Lake. They have certainly been deposited near the sea-shore, and probably when the land was depressed almost or quite to its greatest extent.

On Ferguson River, all the way from Ferguson Lake to Hudson Bay, ancient marine shore-lines may everywhere be seen as scarps, terraces and gravel ridges, stretching in horizontal lines along the sides of the hills, or filling the depressions between rocky points.

On the overland journey southward from Churchill to Split Lake, the most distinct ancient sea-shore was that crossed on the third of December, a short distance north of the headwaters of Owl River, at an elevation of between 500 and 600 feet above sea-level. The passage from the broad wave-washed plain north-east of this ridge, to the rolling till covered country south-west of it, was very marked.

High shore
S.W. of
Churchill.

A similar high shore-line had been ascended and crossed in the winter of 1893, on the overland journey from York Factory to Oxford House, a short distance south of Fox River. Though in both places the ground was completely covered with several feet of snow, yet there can be little doubt that both points lie on the highest raised sea-beach west of the coast of Hudson Bay.

APPENDIX I.

CHIPPEWYAN NAMES OF PLACES IN THE COUNTRY HERE REPORTED ON.

These names were obtained at Churchill, in the autumn of 1894, from Deliazé and "Curly-head," with the assistance of George Oman, the resident interpreter:—

Nū-chō'	Big Island.
Sheth-nā'-ne.	Steep Hill.
Thē-chille-nā'-ra-ai tua.	Holes-in-the-stones Lake.
Dat-chā'-re-kéthe tua.	Eagle Lake.
Thlūl'-ain tua.	Whitefish Lake.
Thē'-chō'-gá tua.	Big-stone Lake.
Thē'-rē-chē tua.	Overflowing Lake.
Thai tua.	Sand Lake.
Thin-telle tua.	Ling Lake.
Thlew'-i-aza tua.	Small-fish Lake.
Thlew'-i-aza dézé.	Small-fish River.
I-then tua.	Caribou Lake.
Ni-jan'-ilini tua.	Boggy-ground Lake.
Ba-ral'-zō'a tua.	Shoal Lake.
Edé-hon' tua.	Horn Lake.
Thē'-tin-an tua.	Seal-hole Lake.
Nū-el-tin' tua.	Frozen-island Lake.
Thá-anné dézé.	Rocky-bank River.
Thá-anné tua.	Rocky-bank Lake.
Thū-chōn-ilini tua.	Big-pine-trees Lake.
Ethlé-ig'li.	The Forks.
Et-thai-ire tua.	Hawk-hill Lake.
Ta-tinne-ai tua.	Deer-crossing Lake.
Edet'-thille dézé.	Horns sticking along the bank, river
Thil-tai tua.	Horns sticking along the bank, lake
To'-bo' tua.	Water-shore Lake.
Yath-kai-ed tua.	Snow Lake.
Hō-yeth-yéze.	Two little hills, with a river flowing between.
I-the-zen tua.	Black-deerskin Lake.
E-ked-a-tan'-e.	A small hill on another hill.
Kail-sheth.	Willow Hill.

Twal-kai tua	Fat-fish Lake.
Thel-wel-kai tua	Snow-bird Lake.
Klok-seth	Big-grass Hill (south of Yath-kyed Lake).
Sas-ne-dē'ze-yethe	Bear-plucking Hill (just beyond the last).
Thā-ānné-yethe	(the next hill).
Gail-lī'nī dē'ze	Rabbit River.
Sa-bail-jē dē'ze	Sabailje's River.
Ka-zon-jēre tua	Long Lake.
Bes-kai tua	Knife Lake.
Des-ta-tha-thē-yethe	Hill between the two rivers.
Nū-gi-ā-za tua	White-island Lake.
Tes'-de-ūli tua	Floating-coals Lake.
Tū-tan-ne tua	Found Lake.
E-chū'-a tua	Fish (Pickerel?) Lake.
Bek-a-nū-klai tua	Many-islands Lake.
Thū-e-zon'e tua <i>or</i> Thlū-e-zon tua	Trout Lake.
Thū-e-zon dēze chēre	Mouth of Trout River.
En-nā tua	Cree Lake.
De-nē' tua	Chippewyan Lake.
Thai-chō'-nū	Big Sandy Island.
Zon-kai tua	Shoal Lake.
Klō-ā-ze-we tua	Kloaze's Lake.
De-bē tua	Partridge (Ruffed Grouse) crop Lake.
Dē-nē-shan-i-li-ni	Moose Hill.
Kai tua	Willow Lake.
Tzan dē-ze-a-ze	Little Iron River.
Tzan dē'-ze	Iron River (Churchill River).
Ta-bil-kē tua	Net Lake.
I-then-dēze	Reindeer River.

APPENDIX II.

VOCABULARY OF WORDS USED BY THE TRIBE OF INLAND ESKIMOS
INHABITING THE BANKS OF KAZAN AND FERGUSON RIVERS.

Obtained from A'-yout, an Eskimo living on the upper part of the Kazan River. It was largely revised at Churchill by Powow, an Eskimo from the same district, with the assistance of the Rev. Jos. Lofthouse as interpreter.

The words are given in very much the same order as in J. W. Powell's "Introduction to the Study of the Indian Languages," and with some slight modifications the sounds of the letters are the same.

The following is a list of the vowel sounds here used:—

a as in English	fat.	o " in English	pot.
ā " " "	far.	ō " " "	go.
â " " "	all.	u " " "	but.
e " " "	met.	ū as "oo" in "	fool.
ē " " "	they.	ai " in "	aisle.
i " " "	pin.	y " " "	year
ī " " "	marine.	ou " " "	out.

(1) PERSONS.

Man	āng'-ūt.
Woman	ār'-nak.
Elderly man	ō-tok'-kak.
Old woman	ār-nak-kwek-kak.
Young man	īn-nū-kūk'-tūk.
Boy	nū'-kā.
Girl	naī'-uk.
Infant	nū-tār'-ak.

(2) PARTS OF THE BODY.

Head	nī-ak'-kuk.
Hair	nut'-tek.
Grey hair	ka'-yuk.
Face	kī'-nak.
Forehead	kou.
Eye	ī'-ik.
Eyebrow	kab'-lūt.

Ear	hi-yü'-tik.
Nose	kaing'-ak.
Beard.	ûm-mik.
Mouth.....	kan'-yek.
Teeth	kî-ût'-ti.
Tongue	ok'-ka.
Chin	tab-lû.
Neck.....	kon-i-lî'-ni-ak.
Body (trunk).....	ka-te.guk.
Shoulder.....	nî'-gu-blû.
Back.....	kai-mer'-i-luk
Breast.....	ûm'-met.
Breast bone.....	hak-kig'-gek.
Belly.....	ner-rok'-kak.
Arm.	tal'-yek.
Hand	ag'-gek.
Fingers.....	hî'-tam-ut.
Thumb	kôb'lû.
Leg.....	nî'-û.
Thigh.....	kok-tô'-ak.
Leg below the knee.....	kan'-nak.
Foot	î-ki-gek.
Toes.....	taip-in-in-û-dik.
Marrow.....	pat'-chuk.

(3) DRESS AND ORNAMENTS.

Hood.....	na'-ha.
Coat (outer deer-skin garment).....	tko-lî'-tok.
Trimming round the coat...	ag'-luk.
Shirt (inner deer-skin garment)	at-tî-yî.
Trousers	ka'-lîk.
Gloves (with fingers).....	ad-gui-ut.
Boots	kam'-mi.
Deer skin blanket.....	kaip'-puk.

(4) DWELLINGS, ETC.

Camp or village	ig-lô.
Tent.....	tô-pek.
Fire.....	ôk'-ka.

Flame	ek-wā-la'.
Smoke	pū-yuk.
Smoke	i-hi-uk.
Ashes	im-mē-an-nī-kō.
Câche	pe-rūl'-yā.
Track	tū-mī.
Iron	hā'wik.
Copper or brass	ka-nū'-huk.
A sound	nā-ki-nim'-na.
A blow	a-nou'-yuk.
Sight	tak-kū-yuk.

(5) IMPLEMENTS.

Bow	pid-jik'-i.
Fishing spear	kuk'-ki-wa.
Deer spear	u-puk-tō.
Head of deer spear	ū'-lū.
Handle of deer spear	i'-pū.
Fishing hook	kar'-i-ō-kuk.
Fishing line of sinew	i'-pī-ū-tuk.
Stick on which line is wound	ū-led'-gūt
Float for fishing net	puk-tak'-kut.
Knife	pī'-lout.
Knife (small penknife)	ō-kūt'-tak.
Snow knife	pan-nē'.
Pipe	pū-lū-yet'-ti.
Pipe stem	i'-pō-ak.
Awl (for boring)	i-kai-tak'.
Needle	mit-kut.
Canoe (for one man)	kai'-ak.
Wooden gunwale-piece of kaiak	ap-pum'-mak.
Double paddle	pou'-tik.
Boat	ū'-mi-ak.
Boat, large	ū-mi-ar'-yū-ak.
Boat, white man's	ka blū-nak-tho-ak.
Sail	tin-gin-er-ou-tuk.
Sledge	kam-ōd'-jik.
Deer skin line	hī'-ni-ak.
Plaited sinew line	pīl-er-ak.
Thread	en-na-lū'-ka.
Parchment	kai'-tin-kū-ni.

Cup.....	im-mo-hū'-yak.
Spoon(musk ox horn).....	ōu'-i-yū'-yak.
Kettle.....	hā-wik.
Lid of kettle.....	ō'-ku-ak.

(6) FOOD.

Meat (of deer).....	ū-yuk.
Dry meat	nip'-kū.
Fat	tūn'-nūk.
Boiled grain.....	kat'-che-wuk.

(7) COLOURS.

Black or blue.....	Ka-re-nek'-tō.
Red	ou-pa-luk'-tō.
White	ka-guk'-tō.

(8) NUMERALS.

1	a-tou'-i-ak.
2	mal'-rōk.
3	ping'-a-yū-ak.
4	hī-tā'-mut.
5	ted'-li-ma.
6	ar'-wing-e-gik.
7	mal'-ung-ik.
8	ping-a-hyū-ni-ik.
9	kū-ling-gūl'-u-ak-tak.
10	koul'-yik.
20	mal-rō-ad-gug'-gik.
30	ping-a-ho-ad-gu'-yik.
40	hī-tam'-ad-gu'-yik.
50	ted'-le-mat-ad-gu'-yik.
Half	nap'-puk.

(9) DIVISIONS OF TIME.

Day.....	ū-blūt.
Night	ū-nū-ak.
Sunrise	he-kan-yek'-pōk.
Sunset	he-kan-rek'-pōk.
Noon	ka-wa-tan-u-a-tī'-wok.
Winter	ū'-ki-ōk.
Spring	ū-ping-rā'-ka.
Summer	ou'-i-a.

(10) ANIMALS.

Reindeer	tūk'-tū.
Buck (deer)	pung'-ni-uk.
Doe	nō-ral'-lik.
Buck (young)	nū-ka-tū'-ak.
Fawn	nō'-kak.
Dog	kaip'-mik.
Fox (white)	ter-re-gū'-ne-ak.
Musk ox	ū-ming-muk.
Wolf	am-mār'-rō.
Wolverine	kāk'-wik.
Crane (brown)	nek'-to-al-li.
Diver (red-throated)	pai'-uk.
Duck	pū-lū-et'-ū-ak.
Goose	ting-ni-ak.
Gull	nou-yet'-yū-ak.
Loon	kak'-kou.
Merganser	a-ān'-yek.
Ptarmigan	pe-kū-lī'-a.
Wavy	kang'-uk.
Fish	ye-kal'-luk.
Ling (<i>Lota maculosa</i>)	tik-tal'-luk.
Pike (<i>Esox lucius</i>)	hyū'-lik.
Perch (?)	hū-lūk-pou'-i.
Sucker	ant'-ni-ak.
Lake trout	ich-chlō'-ra.
Trout (?) (large fish)	kek'-kī-wī-ak'-tō.
Whitefish (?)	an-ak'-luk.
Black fly	mē-lū'-i-ak.
Gad fly	ā'-lung'-i-yū.
Mosquito	kik-tō'-ri-ak.
Spider	nī-nī'-yō.

(11) PLANTS.

Tree	ne-pāk'-tuk.
Shrub (small black spruce)	kaī'-uk-tūk.
Wood, fallen	tīp'-ya.
Wood, dry	tīp'-i-a-lūk.
“ “	pal'-luk.
Willow	ōk'-pik.

Bearberry (<i>Arctostaphylos</i> <i>uva-ursi</i>)	a-tung-gou'-lik.
Labrador tea	nū-kār'-rō.
Grass	ī'-wī.
Moss	ō-ā'-rū.
Lichen (black hair-like)....	king-ou'-yak.

(12) GEOGRAPHIC TERMS, ETC.

North	wāk-nyek-tok.
East.	kā-nak-yek'-tok.
South	nig-yek'-tok.
West	ping-ak-yek'-tok.
River	kōg.
Rapid river	kōg-ni-ak.
Rapid in river.....	kōg-nīk'-yū-ak.
Mouth of river.....	kā-tīn'-i-a.
Lake	kā-man'-yuk.
Small lake.....	kā-man-ou'-uk.
Very small lake or pond...	te-her'-ok.
Bay	kang'-ek-lūk.
Shore.....	hig'-gī-a.
Point of land.....	nū'-ūk.
Island	ka-gek'-tok.
Portage.....	nap'-muk.
Hill.....	king'-a.
Pointed hill with stone on it.	ū-yār'-ra-hūg'-lūk.
Stone placed on hill.....	in-nūk-kūk.
Stone or rock.....	ū-yār'-ruk.

(13) GEOGRAPHIC NAMES.

Fort Churchill.....	ū-yar'-ri ig-lō.
Doobaunt Lake.....	tū'-li-ma-lū'-gyū-a kā-man'-yi.
Little Doobaunt Lake....	tū'-li-ma-lū'-gyū-et-na kā-man'-yi.
Big Lake.....	ang-gi-kū'-ni ka-man'-yi.
Yath-kyed Lake.....	hī-co-lī'-gyū-a ka-man'-yi.
Child Lake.....	nū-tar'-a-wīt ka-man'-yi.
Kamanuriak Lake.....	ka-man-yūr'-yū-ak.
Kazan River.....	īn'-nwi kōg.
Seal River.....	net-chil kōg.
Pallelluah	pal'-lel'-yū-a.

(14) SOCIAL ORGANIZATION.

An Eskimo.....	in-nwī.
Chief.....	i-hyū-mat'-tok.
Trader.....	i-hyū-ma-tēr'ok.
White man.....	kab-lū-na.

(15) KINSHIP.

Son.....	ir-ner'-ik.
Daughter.....	pa'-nik.
Father.....	at-ta'-ta.
Mother.....	an-nū'-na.
Wife.....	nū'-li-a.
Sister.....	nē'-yuk.
Twins.....	nū-kār'-a.
Grandchild.....	ok-kō'-ga.

(16) THE FIRMAMENT.

Cloud.....	nū-ū'-ya.
Sky.....	al-la-kū'-ni.
Sun.....	hī-ak-kēn'-i-ak.
Moon.....	yat-ke'.
Stars.....	ū-blū-ri-ak.
Aurora.....	ak'-ka.
Hoar frost.....	hā-kū-ni.
Snow.....	ap'-pūt.
Ice.....	hī'-kō.
Rain.....	nī-pal'-lū.
Water.....	im'-mek.
Tide.....	pit'-tak.
Sea.....	tār-rē-ō.
Wind.....	an-nōr'-rē.
Darkness.....	tā'-kū-ni.

(17) PRONOUNS, ADJECTIVES, ADVERBS, ETC.

I.....	u-wung'-a.
Thou.....	ig'-bi.
Small.....	mik'-ki-kū'-ni.
Large.....	ang'-gi-kū-ni.
Long.....	tā'-ki-kū-ni.
Short.....	nā'-hi-kū-ni.

Narrow	ik'-ik-i-kū'-ni.
Broad	i-kek'-to-kū'-ni.
Light	ok'-e-kū'-ni.
Heavy	ok-u-mai'-i-kū'-ni.
Near	kan'-i-kū'-ni.
Far	o-má-hi-kū'-ni.
Flat	man'-i-kū'-ni.
Cold	ik'-ki.
"	ik'-ki-an-ni-kū'-ni.
Warm	ik'-ki-an-ě'-kū'-ni.
Hot (water)	ū'-na-kū'-ni.
Good	pī-chi-ak.
Bad	pī-tou-i-kū'-ni.
Lost	na-lūn'-i-kū'-ni.
Broken	he-kō-met'-uk.
Departed	oug'-luk-pōk.
That	te-i-ba.
Where	nā'-nī.
There	mā'-nī.
Where is it	nan-nim'-ne.
On this side of	mi-kā'-ni.
On that side of	o-ma-tā'-ni.
Today	ū-blū'-mi.
So	ta-man-nō.
There is none	nouk.
Plentiful	mai (in suffix).
Wanting (or no!)	nā'-ga (in suffix).

(18) VERBS.

To see	tak'-kō.
To sleep	hī nik-tūk.
To portage	nap-muk-tō.
To travel	kak-mal'-tō.
To walk	pi-hūk'-tuk.
To run	ak-pā'-tō.
To talk	ok-kak'-tō.
To drink	im-ma-kyū'-ya.
To "	im-mek'-tō.
To stoop and drink	hik-kī'-uk.
To dip up	kal-u-ing'-a.
To eat	ner-rā'-yuk.
To grasp	te-hō-yuk.

To brush off the snow.....	â-yek'-tôk.
To sneeze.....	tá-ri-uk-to-kû-ni.
To cry.....	il-luk'-kû-ni.
To laugh.....	kap-ma-tuk'-tô.
To be pleased.....	koû-gak-tô.
To be displeased.....	an-nû-kû-ni.
To write.....	ik-ke-rok'-tô.
To cook.....	l-rê'-yuk.
To cut.....	kî-lêk'-tok.
To plane (wood).....	hâ-ner-â-mik.
To saw.....	û-lût.
To splash.....	mal'-lô.
To squeak.....	nî'-ko-lak-tô.
It is raining.....	nî-pal'-i-kû-ni.
It is snowing.....	kan-yi-kû-ni.
It is stormy (on the water).....	at-kon-i-kû-ni.
It is lost.....	nou-gim-na.
It smells nice.....	má-ma-kû-ni.
It smells unpleasant.....	ma-mai'-i-kû-ni.
I do not know.....	a-mî'-a-huk.
Arise!.....	tô-pal-ye'-ik.
Go!.....	ún-gak-wok'-to.
Come!.....	kai'-uk.

(19) NEW WORDS.

Handkerchief.....	kon-ji-hi-nê'-rût.
Muffler.....	tap'-pi.
Paper.....	al-li-lê'-uk.
Buttons.....	han-nê'-i-ak.
Tobacco.....	tîp'-le-tô'-rût.
Rifle.....	am-me-hû-ek-ta-yû'-yuk.
Gun (single barrell'd).....	kai-ûk-tô-tô.
“ (double “).....	mal-rôl'-yî.
Gunpowder.....	ar'-yet.
Gun caps.....	ik'-ni-uk.
Bullet.....	kar'-i-ok.
Biscuit.....	nek-lû-uk.
Bottle.....	kî-li-an-â'-kut.
Fork.....	nî-ô-gî-tik.
Plate.....	pâ-wu-tuk.

APPENDIX III.

PLANTS (EXCLUSIVE OF ALGÆ AND FUNGI).

Collected by J. W. Tyrrell, C.E., D.L.S.

In 1893, along the line of route between Lake Athabasca and the west coast of Hudson Bay, and in 1885 at Ashe Inlet, on the north shore of Hudson Straits; with which is incorporated a small collection made by Miss Marjorie Lofthouse at Fort Churchill.

The species collected from the Barren Lands are marked *B* those from the forested country south of the Barren Lands, or in isolated groves of timber on the banks of the river, north of the general limit of the forest, are marked *W*. Any species collected both from the Woods and from the Barren Lands are marked *W.B.*, or *B.W.*, according to whether they are woodland species extending into the Barren Lands, or Arctic species extending south into the forest.

Determined by Professor John Macoun, M.A.

I. RANUNCULACEÆ.

1. *Anemone patens*, L., var. *Nuttalliana*, Gray.—*W*.
Fort Chippewyan, Lake Athabasca, June 19.
2. *Anemone parviflora*, Michx.—*W.B.*
North shore of Lake Athabasca. Limestone Island in Nicholson Lake, and the west shore of Hudson Bay at Fort Churchill.
3. *Anemone Richardsonii*, Hook.—*W*.
Telzoa River, just below Daly Lake.
4. *Anemone multifida*, Poir.—*W*.
Woodcock Portage, on Stone River.
5. *Ranunculus affinis*, R. Br.—*B*.
Barlow Lake, Telzoa River. Telzoa River, between Schultz and Baker lakes. South shore of Chesterfield Inlet, near its mouth. Fort Churchill.
6. *Ranunculus Lapponicus*, L.—*B*.
West shore of Doobaunt Lake, near the mouth of Telzoa River.
7. *Ranunculus hyperboreus*, Rotth.—*W*.
Telzoa River, just below Daly Lake.

II. PAPAVERACEÆ.

8. *Papaver nudicaule*, L.—*B*.
Telzoa River, between Schultz and Baker lakes. This species was also collected at Ashe Inlet, on the north shore of Hudson Straits, in 1885.

III. FUMARIACEÆ.

9. *Corydalis glauca*, Pursh.—*W*.
North-west and north shores of Lake Athabasca. Esker near the Narrows of Daly Lake.
10. *Corydalis aurea*, Willd.—*W*.
Rocky Island, on the north side of Lake Athabasca, west of Fond du Lac.

IV. CRUCIFERÆ.

11. *Cardamine pratensis*, L., var. *angustifolia*.—B.
Island near the centre of Boyd Lake. Limestone Island in Nicholson Lake.
Fort Churchill.
12. *Arabia lyrata*, L.—W.
North shore of Lake Athabasca.
13. *Arabia humifusa*, var. *pubescens*, Wat.—W.
North-west angle of Lake Athabasca. Eaker near the Narrows of Daly Lake.
This species had not previously been found west of Hudson Bay.
14. *Barbarea vulgaris*, R. Br.—W.
Cracking Stone Point, north shore of Lake Athabasca. Red Hill, on the
west shore of Hinde Lake.
15. *Sisymbrium humile*, C. A. Meyer.—W.
Fort Chippewyan, Lake Athabasca.
16. *Cardamine digitata*, Rich.—B.
Loudon Rapids, above Forks of Telzoa River. Mouth of Chesterfield Inlet.
Not found elsewhere since it was collected by Sir John Richardson near the
mouth of the Coppermine River.
17. *Draba hirta*, L.—B.
Limestone Island, Nicholson Lake. Loudon Rapid, above the Forks of
Telzoa River. Also at Ashe Inlet, on the north shore of Hudson Strait.
18. *Draba incana*, L.—B.
Loudon Rapids, above the Forks of Telzoa River. Fort Churchill, on the
west coast of Hudson Bay.
19. *Draba nemorosa*, L., var. *leiocarpa*, Lindb.—W.
Fond du Lac, Lake Athabasca.
20. *Draba stellata*, Jacq.—B.
North-west shore of Doobaunt Lake.
21. *Cochlearia officinalis*, L.—B.
Mouth of Chesterfield Inlet.
22. *Eutrema Edwardsii*, R. Br.—B.
North-west shore of Doobaunt Lake.
23. *Nasturtium palustre*, D.C.—W.
Fond du Lac, Lake Athabasca.

V. VIOLACEÆ.

24. *Viola palustris*, L.—W.
East and north shores of Carey Lake. These are the most northern localities
in Canada where this species has been found.
25. *Viola canina*, L., var. *sylvestris*, Regel.—W.
Fond du Lac, Lake Athabasca. South end of Daly Lake.

VI. CARYOPHYLLACEÆ.

26. *Silene acaulis*, L.—B.
Doobaunt Lake, west shore. North end of Wharton Lake. Also at Ashe
Inlet on Hudson Straits.
27. *Lychnis apetala*, L.—B.
Mouth of Chesterfield Inlet.
28. *Lychnis affinis*, Vahl.—B.
Doobaunt Lake, north-west shore.
29. *Arenaria lateriflora*, L.—W.
Near the south end of Daly Lake.
30. *Arenaria peploides*, L.—B.
Ashe Inlet, on the north side of Hudson Straits.
31. *Stellaria longipes*, Goldie.—B. W.
Barlow Lake. Carey Lake. Wharton Lake. Doobaunt Lake, west shore.
Loudon Rapids, above the Forks of Telzoa River. Fort Churchill.

32. *Stellaria longipes*, Goldie, var. *lata*, Wats.
Barlow Lake and Limestone Island in Nicholson Lake.—B.
33. *Stellaria borealis*, Bigel.—W.
Red Hill, on the west shore of Hinde Lake.
34. *Cerastium alpinum*, L.—B.
Limestone Island in Nicholson Lake, Wharton Lake, Loudon Rapids, above the Forks of Telzoo River, Telzoo River, between Schultz and Baker lakes, Mouth of Chesterfield Inlet, Fort Churchill, Ashe Inlet, on the north side of Hudson Straits.

VII. GERANIACEÆ.

35. *Geranium Carolinianum*, L.—W.
North shore of Lake Athabasca, a short distance west of Fond du Lac.

VIII. SAPINDACEÆ.

36. *Acer spicatum*, Lam.—W.
Fort Chippewyan, Lake Athabasca. This is the most northerly locality in Canada from which this species has been recorded.

IX. LEGUMINOSÆ.

37. *Astragalus alpinus*, L.—W.
North shore of Lake Athabasca at Fond du Lac, and near Big Fowl Island, Esker near the Narrows of Daly Lake.
38. *Spizsia* (*Oxytropis*) *Belli*, Britt.—B.
Loudon Rapids, above the Forks of Telzoo River, Mouth of Chesterfield Inlet.
The only other locality from which this species has been collected is Digges Island, Hudson Bay, where it was found by Dr. Bell in 1884. It was described by Mr. Britton in 1894 from the specimens collected at the second and third of the above localities.
39. *Oxytropis campestris*, L., var. *coriacea*, Koch.—B.
Ashe Inlet, on the north shore of Hudson Straits.
40. *Oxytropis leucantha*, Pers.—B.
Telzoo River, between Schultz and Baker lakes, Mouth of Chesterfield Inlet, Fort Churchill.
41. *Hedysarum boreale*, Nutt.—B.
Loudon Rapids, above the Forks of Telzoo River.
42. *Hedysarum Mackenzii*, Richard, L.—B. W.
Fort Churchill. Ashe Inlet, on the north side of Hudson Straits.

X. ROSACEÆ.

43. *Prunus Pennsylvanica*, L.—W.
North-west angle of Lake Athabasca. Esker near Narrows of Daly Lake.
44. *Rubus chamaemorus*, L.—W. B.
Fort Churchill. Common in swampy places from Lake Athabasca northward to the edge of the woods. Grove on the north shore of Carey Lake, and at Loudon Rapids, near the Forks of Telzoo River. It was also found at Ashe Inlet, on the north side of Hudson Straits.
45. *Rubus arcticus*, L., var. *grandiflorus*, Ledeb.—W.
North shore of Lake Athabasca. Barlow Lake. North shore of Carey Lake, Fort Churchill.
46. *Rubus strigosus*, Michx.—W.
Banks of Stone River. In an isolated grove of white spruce on the north shore of Carey Lake. This would seem to have been an isolated locality, at some considerable distance north of its general northern limit.

47. *Dryas integrifolia*, Vahl.—B.
Carey Lake. Limestone Island in Nicholson Lake. West shore of Doobaunt Lake. Loudon Rapids above the Forks of Telzoa River. Fort Churchill. Ashe Inlet on the north shore of Hudson Straits.
48. *Fragaria Canadensis*, Michx.—W.
North shore of Lake Athabasca and Woodcock Portage on Stone River. This species, which has usually been confounded with *F. Virginiana*, was also collected in the same year by Miss Taylor at Fort Smith on Slave River.
49. *Potentilla Norvegica*, L.—W.
Woodcock Portage, on Stone River. Red Hill, on the west shore of Hinde Lake.
50. *Potentilla nivea*, L.—B.
Telzoa River, between Schultz and Baker lakes. Mouth of Chesterfield Inlet. Fort Churchill.
51. *Potentilla palustris*, Scop.—W.
Stony flats on the banks of Telzoa River, just below Daly Lake.
52. *Potentilla fruticosa*, L.—W.
North shore of Lake Athabasca, a little distance west of Fond du Lac.
53. *Potentilla ana*, Willd.—B.
Shore of Hudson Bay, north of Marble Island. Ashe Inlet, on the north shore of Hudson Straits.
54. *Potentilla tridentata*, Solander.—W.
Woodcock Portage, Stone River.
55. *Amelanchier alnifolia*, Nutt.—W.
North-west angle, Lake Athabasca.

XI. SAXIFRAGACEÆ.

56. *Saxifraga oppositifolia*, L.—B.
Telzoa River, between Schultz and Baker lakes. Mouth of Chesterfield Inlet. Ashe Inlet, on the north shore of Hudson Straits.
57. *Saxifraga cespitosa*, L.—B.
Telzoa River, between Schultz and Baker lakes. Mouth of Chesterfield Inlet. Ashe Inlet.
58. *Saxifraga rivularis*, L.—B.
Loudon Rapids, above the Forks of Telzoa River. Ashe Inlet.
59. *Saxifraga cernua*, L.—B.
North-west shore of Doobaunt Lake. Loudon Rapids, above the Forks of Telzoa River. Telzoa River, between Schultz and Baker lakes. Mouth of Chesterfield Inlet. Fort Churchill.
60. *Saxifraga nivalis*, L.—B.
Mouth of Chesterfield Inlet.
61. *Saxifraga hieracifolia*, Waldst and Kit.—B.
North shore of Doobaunt Lake.
62. *Saxifraga punctata*, L.—B.
North-west shore of Doobaunt Lake.
This species had not previously been recorded east of the Rocky Mountains.
63. *Saxifraga Hirculus*, L.—B.
North-west shore of Doobaunt Lake.
64. *Saxifraga tricuspidata*, Retz.—B. W.
Fort Chippewyan, Lake Athabasca. North shore of Carey Lake. Wharton Lake. Loudon Rapids, above the Forks of Telzoa River. Mouth of Chesterfield Inlet. Ashe Inlet.
65. *Chrysosplenium alternifolium*, L.—B.
Limestone Island, Nicholson Lake.
66. *Parnassia Kotzebuei*, Cham. and Schl.—W.
South end of Daly Lake.

TYRRELL
67. Par
68. Ribe
69. Ribe
70. Ribe
71. Ribe
72. Hipp
73. Hipp
74. Epilo
75. Epilo
76. Epilo
77. Cornu
78. Viburn
79. Linne
80. Galium
81. Erigeron
82. Erigeron
83. Antenna
84. Achilla
14

67. *Parnassia palustris*, L.—W.
Fort Churchill.
68. *Ribes oxycanthoides*, L.—W.
North shore of Lake Athabasca, near Fond du Lac.
69. *Ribes rubrum*, L.—W.
Fort Chippewyan, Lake Athabasca.
70. *Ribes Hudsonianum*, Richards.—W.
Fort Chippewyan, Lake Athabasca.
71. *Ribes prostratum*, L'Her.—W.
North shore of Lake Athabasca. Esker near the Narrows of Daly Lake.
East and north shores of Carey Lake.

XII. HALORAGACEÆ.

72. *Hippuris vulgaris*, L.—B.
Mouth of Chesterfield Inlet.
73. *Hippuris maritima*, L.—B. W.
Red Hill, on the shore of Hinde Lake. Mouth of Chesterfield Inlet.

XIII. ONAGRACEÆ.

74. *Epilobium angustifolium*, L.—W. B.
Esker near the Narrows of Daly Lake. Ashe Inlet, Hudson Straits.
These localities probably mark the northern range of this species.
75. *Epilobium latifolium*, L.—B.
West shore of Doobaunt Lake. Loudon Rapids above the Forks of Telzoa River, where the flowers were just appearing on Aug. 25. Fort Churchill.
Ashe Inlet.
76. *Epilobium lineare*, Gray.—B.
Red Hill, on the shore of Hinde Lake. Mouth of Chesterfield Inlet.

XIV. CORNACEÆ.

77. *Cornus Canadensis*, L.—W.
North shore of Lake Athabasca. South end of Daly Lake.

XV. CAPRIFOLIACEÆ.

78. *Viburnum pauciflorum*, Pylæie.—W.
North shore of Lake Athabasca. Esker near the Narrows of Daly Lake.
9. *Lancea borealis*, Gronov.—W.
Elizabeth Rapids, Store River. Esker near the Narrows of Daly Lake.
North shore of Carey Lake. Fort Churchill.

XVI. RUBIACEÆ.

80. *Galium trifidum*, L.—W.
Red Hill, on the shore of Hinde Lake.

XVII. COMPOSITÆ.

81. *Erigeron uniflorus*, L.—B.
Loudon Rapids, above the Forks of Telzoa River.
82. *Erigeron eriophorus*, J. Vahl.—B.
North end of Wharton Lake.
83. *Antennaria alpina*, Gaertn.—B.
West shore of Doobaunt Lake.
84. *Achillea millefolium*, L., var. *nigrescens*, L.—W. B.
Woodcock portage, Stone River. Fort Churchill. Ashe Inlet

85. *Matricaria inodora*, L., var. *nana*, Hook.—*W.*
Fort Churchill.
86. *Artemisia borealis*, Pall., var. *Wormskioeldii*, Bess.—*B. W.*
Telzoa River, just below Daly Lake, and east end of Aberdeen Lake.
87. *Petasites palmata*, Gray.—*W.*
Fond du Lac, Lake Athabasca.
88. *Petasites sagittata*, Gray.—*B.*
Limestone Island, Nicholson Lake. Ashe Inlet, Hudson Straits.
89. *Arnica alpina*, Olin.—*B. W.*
North shore of Lake Athabasca. Esker near Narrows of Daly Lake. West shore of Doobaunt Lake. Loudon Rapids, above the Forks of Telzoa River. Fort Churchill. Ashe Inlet.
90. *Senecio palustris*, Hook., var. *congesta*, Hook.—*B.*
West shore of Doobaunt Lake. Fort Churchill. Ashe Inlet.
91. *Senecio aureus*, L., var. *borealis*, Tor. and Gr.—*B.*
Limestone Island in Nicholson Lake.
92. *Senecio aureus*, L., var. *balsamite*, Tor. and Gr.—*W.*
Fort Churchill.
93. *Saussurea alpina*, Hook.—*L.*
North end of Wharton Lake.
94. *Taraxacum officinale*, Weber, var. *alpinum*, Koch.—*B.*
Loudon Rapids, above the Forks of Telzoa River. Mouth of Chesterfield Inlet. Fort Churchill.

XVIII CAMPANULACEÆ.

95. *Campanula uniflora*, L.—*B.*
Loudon Rapids, above the Forks of Telzoa River.

XIX VACCINIACEÆ.

96. *Vaccinium Canadense*, Kalm.—*W.*
South end of Daly Lake.
97. *Vaccinium uliginosum*, L.—*W. B.*
North shore of Lake Athabasca. Telzoa River, just below Daly Lake. Carey Lake. Doobaunt Lake. Loudon Rapid, above Forks of Telzoa River. Fort Churchill.
98. *Vaccinium Vitis-Idæa*, L.—*W. B.*
North shore of Lake Athabasca. Daly Lake. Doobaunt Lake. Loudon Rapids, above the Forks of Telzoa River. Fort Churchill.
While both this and the preceding species extend for a considerable distance into the Barren Lands, the bushes are small and bear very little fruit.
99. *Oxycoccus vulgaris*, Pursh.—*W.*
Esker near the middle of Daly Lake, and stony banks of Telzoa River just below the lake.

XX. ERICACEÆ.

100. *Arctostaphylos alpina*, Spreng.—*B. W.*
Island near the middle of Boyd Lake. Telzoa River, between Schultz and Baker lakes. Mouth of Chesterfield Inlet. Fort Churchill. Ashe Inlet, Hudson Straits.
(In 1894 the most southern locality at which this species was observed was on the hill south of Kasba Lake. In 1896 it was seen in the swamp at Cross Portage, north of Seepiwisk Lake, Nelson River.—J.B.T.)
101. *Arctostaphylos Uva-ursi*, Spreng.—*W.*
North to the edge of Barren Lands.
102. *Cassandra calyculata*, Don.—*W.*
North-west shore, Lake Athabasca. South end of Selwyn Lake.

103. *Cassiope tetragona*, Don.—*B.*
Shores of Doobaunt Lake. Telzoa River, between Schultz and Baker lakes.
Mouth of Chesterfield Inlet. This is one of the plants most commonly
used for fuel by those travelling in the Barren Lands.
104. *Andromeda polifolia*, L.—*W.B.*
North shore of Athabasca Lake. South end of Selwyn Lake. Esker near
the middle of Daly Lake. West shore of Doobaunt Lake. Fort Churchill.
105. *Loiseleuria procumbens*, Desv.—*B.*
Boyd Lake.
106. *Bryanthus taxifolius*, Gray.—*B.*
Loudon Rapids, above Forks of Telzoa River.
107. *Kalmia glauca*, Ait.—*W.*
Fond du lac, Lake Athabasca. Esker near middle of Daly Lake.
108. *Ledum latifolium*, Ait.—*W.*
North shore of Lake Athabasca. Daly Lake. Farther north it is replaced
by the next following species.
109. *Ledum palustre*, L.—*B.W.*
South end of Daly Lake. Carey Lake. Shores of Doobaunt Lake. Whar-
ton Lake. Loudon Rapids, above Forks of Telzoa River. Mouth of
Chesterfield Inlet. Fort Churchill.
110. *Rhododendron Lapponicum*, Wahl.—*B.*
Limestone Island, Nicholson Lake. Shores of Doobaunt Lake. Fort
Churchill.
111. *Pyrola minor*, L.—*W.*
Red Hill, on the shore of Hinde Lake.
112. *Pyrola secunda*, L., var. *pumila*, Gray.—*W.B.*
North shore of Carey Lake. Loudon Rapids, above the Forks of Telzoa
River. This is the most northern point at which this species was observed.
113. *Pyrola rotundifolia*, L., var. *pumila*, Hook.—*B.W.*
North shore of Lake Athabasca. Carey Lake. Wharton Lake. Loudon
Rapids on Telzoa River. Fort Churchill. Ashe Inlet.

XXI. PLUMBAGINACEÆ.

114. *Armeria vulgaris*, Willd.—*B.*
West shore of Doobaunt Lake. Loudon Rapids above the Forks of Telzoa
River. Mouth of Chesterfield Inlet.

XXII. PRIMULACEÆ.

115. *Primula Mistassinica*, Michx.—*W.*
North shore of Lake Athabasca. Fort Churchill.
116. *Trientalis Americana*, Pursh.—*W.*
Elizabeth Falls, Stone River.
117. *Androsace septentrionalis*, L.—*W.*
Fort Churchill.

XXIII. GENTIANACEÆ.

118. *Mengyanthes trifoliata*, L.—*W.*
Woodcock Portage, Stone River.

XXIV. HYDROPHYLLACEÆ.

119. *Phacelia Franklinii*, Gray.—*W.*
North shore of Lake Athabasca. Woodcock Portage on Stone River.

XXV. SCROPHULARIACEÆ.

120. *Castilleja pallida*, Kunth.—*B*.
Limestone Island in Nicholson Lake. Shore of Doobaunt Lake. Loudon Rapids, above the Forks of Telzoa River.
121. *Pedicularis Lapponica*, L.—*B*.
Mouth of Chesterfield Inlet. Ashe Inlet, on Hudson Straits.
122. *Pedicularis caphrasioides*, Stephan.—*B. W*.
Esler near the middle of Daly Lake. North shore of Carey Lake. Loudon Rapids, above the Forks of Telzoa River. Fort Churchill.
123. *Pedicularis hirsuta*, L.—*B*.
Limestone Island in Nicholson Lake. West shore of Doobaunt Lake. Loudon Rapids.
124. *Pedicularis flammæa*.—*B*.
Limestone Island in Nicholson Lake.
125. *Pedicularis capitata*, Adams.—*B*.
East shore of Carey Lake.
126. *Bartsia alpina*, L.—*W*.
Fort Churchill.

XXVI. LENTIBULARIACEÆ.

127. *Pinguicula villosa*, L.—*W*.
Daly Lake. Boyd Lake.
128. *Pinguicula vulgaris*, L.—*W*.
Carey Lake. Fort Churchill.

XXVII. POLYGONACEÆ.

129. *Polygonum viviparum*, L.—*B*.
Limestone Island in Nicholson Lake. West shore of Doobaunt Lake. Loudon Rapids, above the Forks of Telzoa River.
These are among the most northern localities at which these species has been found in Canada.
130. *Oxyria digyna*, Campdera.—*B*.
Mouth of Chesterfield Inlet.
Ashe Inlet on the north shore of Hudson Straits.

XXVIII. MYRICACEÆ.

131. *Myrica Gale*, L.—*W*.
North-west angle of Lake Athabasca.

XXIX. CUPULIFERÆ.

132. *Betula papyrifera*, Michx.—*W*.
North shore of Lake Athabasca.
Daly Lake.
The Indians make their canoes from the bark of this tree. Trees sufficiently large for canoes were seen as far north as the north end of Selwyn Lake, and the northern bend of Cochrane River. From these places northward it gradually decreases in size, until it disappears at about the northern limit of the forest.—J. B. T.
133. *Betula pumila*, L.
Red Hill on the west shore of Hinde Lake.
Boyd Lake.
134. *Betula glandulosa*, Michx.
Daly Lake.
Loudon Rapids, above the Forks of Telzoa River.
Doobaunt River, between Schultz and Baker lakes.
Fairly common, as a small shrub on the Barren Lands as far north as Ferguson River.—J. B. T.
135. *Alnus viridis*, DC.—*W*.
Carey Lake. Quartzite Lake, on Ferguson River.

XXX SALICACEÆ.

136. *Salix petiolaris*, Smith.—*W.*
North-west shore, Lake Athabasca.
137. *Salix desertorum*, Rich.—*W.*
North shore of Lake Athabasca.
138. *Salix Brownii*, Bebb.—*W.B.*
North shore of Lake Athabasca.
North-west shore of Doobaunt Lake.
Ashe Inlet, Hudson Straits.
139. *Salix Richardsonii*, Hook.—*B.*
Mouth of Chesterfield Inlet.
Not previously recorded from the vicinity of Hudson Bay.
140. *Salix reticulata*, L.—*B.*
Limestone Island in Nicholson Lake.
Loudon Rapids, above the Forks of Telzoo River.
141. *Salix herbacea*, L.—*W.B.*
Esker near the middle of Daly Lake.
Mouth of Chesterfield Inlet.
Ashe Inlet, on the north side of Hudson Straits.
142. *Salix rostrata*, Rich.—*W.*
North shore of Lake Athabasca.
Elizabeth Rapids, Stone River.
143. *Salix speciosa*, Hook and Arn.—*B.*
Mouth of Chesterfield Inlet.
144. *Salix glauca*, L., var. *villosa*, And.—*B.*
Doobaunt River, between Schultz and Baker lakes.
145. *Salix phyllifolia*, L.—*B.*
Shore of Doobaunt Lake.
Doobaunt River, between Schultz and Baker lakes.
Mouth of Chesterfield Inlet.
146. *Salix balsamifera*, Barratt.—*W.*
West shore of Daly Lake.
This species was not before known to occur north of the Saskatchewan River.
147. *Populus balsamifera*, L.—*W.*
North shore of Lake Athabasca.
Limbs, believed to be of this species, were found lying on the sand at the Forks of the Telzoo River, having drifted down the West Branch to that place.
148. *Populus tremuloides*, Michx.—*W.*
North shore of Lake Athabasca.
Esker near the narrows of Daly Lake.
The latter locality is the northern limit of the tree in this longitude. On the head waters of the Thlewiaza River it was found to range as far north as an Esker in latitude 60°. A few small trees were also observed on the raised beaches near Fort Churchill.—J.B.T.

XXXI. EMPETRACEÆ.

149. *Empetrum nigrum*, L.—*W.B.*
Daly Lake.
Hinde Lake.
Carey Lake.
Loudon Rapids on Doobaunt River.
Mouth of Chesterfield Inlet.
Ashe Inlet on Hudson Straits.
Very little fruit was found on the bushes north of the edge of the Barren Lands.

XXXII. CONIFERÆ.

150. *Juniperus communis*, L.—W.
Fort Chippewyan, Lake Athabasca.
Esker near the middle of Daly Lake.
North shore of Carey Lake.
155. *Juniperus Sabina*, L., var. *procumbens*, Pursh.—W.
Fort Chippewyan, Lake Athabasca.
152. *Pinus Banksiana*, Lambert.—W.
On dry sandy or rocky slopes as far north as the north end of Selwyn (and Theitaga) lakes.
153. *Picea nigra*, Link.—W.B.
North shore of Lake Athabasca.
Telzoa River, just below Daly Lake.
This species occurs in scattered grooves down the Telzoa River to Doobaunt Lake (and down the Kazan River to Angikuni Lake, while one isolated grove was seen on a sandy flat not far above Yath-kyed Lake). On the shore of Hudson Bay it reaches its northern limit at the mouth of Nelson River. The most northern examples are spreading shrubs, in the middle of which may be a small upright stem four or five feet high.—J.B.T.
154. *Picea alba*, Link.—W.B.
North shore of Lake Athabasca.
The sandy eskers near Hinde and Boyd lakes were thinly covered with fine large trees of this species. Groves of large trees were also growing on the wet, but well drained, flats or slopes beside the Telzoa River down to within a short distance of Doobaunt Lake. Many large drifted trunks were also found at the Forks below this lake. On the Kazan River this species was not noticed north of Ennadai Lake. Its northern limit on the shore of Hudson Bay is at Little Seal River, north of Fort Churchill, where it replaces the preceding species in the wet swamps near the shore.—J.B.T.
155. *Larix Americana*, Michx.—W.B.
Telzoa River, as far north as Doobaunt Lake.
Kazan River, as far north as the grove of Black Spruce above Yath-kyed Lake, it being the larger tree of the two.
On the shore of Hudson Bay as far north as the mouth of Little Seal River, associated with white spruce.—J.B.T.

XXXIII. LILIACEÆ.

156. *Smilacina trifolia*, Desf.—W.
Esker near middle of Daly Lake.
157. *Maianthemum Canadense*, Desf.—W.
North shore of Lake Athabasca.
158. *Allium Schanoprasum*, L.—W.
North shore of Lake Athabasca.
159. *Tofieldia borealis*, Wahl.—W.B.
Barlow Lake.
Loudon Rapids, above the Forks of Telzoa River.
Fort Churchill.

XXXIV. ORCHIDACEÆ.

160. *Orchis rotundifolia*, Pursh.—W.
Fort Churchill.

XXXV. JUNCACEÆ.

161. *Luzula spadiacea*, D.C., var. *melanocarpa*, Meyer.—B.
Island near the middle of Boyd Lake.
162. *Luzula campestris*, Desv.—B.
Island near the middle of Boyd Lake.
163. *Luzula campestris*, Desv., var. *vulgaris*, Hook.—B.
West shore of Doobaunt Lake.

XXXVI. CYPERACEÆ.

164. *Scirpus cespitosus*, L.—B.
Island near the middle of Boyd Lake.
165. *Eriophorum polystachyon*, L.—W.B.
West shore of Hinde Lake.
Island near the middle of Boyd Lake.
Limestone Island in Nicholson Lake.
West shore of Doobaunt Lake.
Ashe Inlet on Hudson Straits.
166. *Eriophorum vaginatum*, L.—W.B.
Esker near the middle of Daly Lake.
167. *Eriophorum capitatum*, Host.—B.
Ashe Inlet, on Hudson Straits.
168. *Carex rariflora*, Smith.—B.
Loudon Rapids, above the Forks of Telzoa River.
169. *Carex canescens*, L., var. *alpicola*, Wahl.—W.
Telzoa River, just below Daly Lake.
Boyd Lake.
170. *Carex misandra*, R. Br.—W.B.
West shore of Hinde Lake.
Mouth of Chesterfield Inlet.
171. *Carex aquatilis*, Wahl.—W.
West shore of Hinde Lake.
172. *Carex vulgaris*, Fries., var. *hyperborca*, Boott.—W.
Daly Lake. Hinde Lake.
Boyd Lake.
173. *Carex Magellanica*, Lam.—W.
Esker near the middle of Daly Lake.
174. *Carex saxatilis*, L.—W.
Hinde Lake. Barlow Lake.
175. *Carex rotundata*, Wahl.—B.
Mouth of Chesterfield Inlet.

XXXVII. GRAMINEÆ.

176. *Hierochloa alpina*, R. & S.—B.
West shore of Doobaunt Lake.
Loudon Rapids above the Forks of Telzoa River.
Mouth of Chesterfield Inlet.
177. *Arctagrostis latifolia*, Griseb.—W.B.
West shore of Hinde Lake.
Loudon Rapids, above the Forks of Telzoa River.
178. *Arctophila Laestadii*, Rupt.—W.
West shore of Hinde Lake.
179. *Elymus arenarius*, L.—W.
Black Lake on Stone River.
180. *Elymus mollis*, Trin.—B.
Doobaunt River, between Schultz and Baker lakes.
Mouth of Chesterfield Inlet.
181. *Calamagrostis Langsdorffii*, Kunth.—W.
Black Lake on Stone River.
Esker near the middle of Daly Lake.
Telzoa River just below Daly Lake.
182. *Calamagrostis Canadensis*, Hook.—B.
Limestone Island in Nicholson Lake.
183. *Poa alpina*, L.—B.
Loudon Rapids, above the Forks of Telzoa River.

184. *Poa angustata*, R. Br.—*B.*
Boyd Lake.
185. *Poa cenisia*, All.—*B.*
Limestone Island in Nicholson Lake.
London Rapids, above the Forks of Telzoa River.
186. *Triactum subspicatum*, Beauv.—*W.*
Esker near the middle of Daly Lake.

XXXVIII. Equisetaceæ.

187. *Equisetum sylvaticum*, L.—*W.*
Esker near the middle of Daly Lake.

XI. FILICES.

188. *Polypodium vulgare*, L.—*W.*
North shore of Lake Athabasca.
189. *Phegopteris Dryopteris*, Fee.—*B.*
Island near the middle of Boyd Lake.
190. *Aspidium fragrans*, Swartz.—*W. B.*
Daly Lake. Carey Lake.
Doobaunt River, between Schultz and Baker lakes.
Mouth of Chesterfield Inlet.
191. *Cystopteris fragilis*, Bernh.—*B.*
Limestone Island in Nicholson Lake.
Mouth of Chesterfield Inlet.
192. *Woodsia Ilwensis*, R. Br.—*W.*
North shore of Lake Athabasca.
Grove of white spruce on the north shore of Carey Lake.

XLI. Lycopodiaceæ.

193. *Lycopodium annotinum*, L.—*W.*
Cracking-stone Point, Lake Athabasca.
North shore of Carey Lake.
194. *Lycopodium annotinum*, L., var. *alpestre*, Hartm.—*W.*
Telzoa River, below Daly Lake.
195. *Lycopodium complanatum*, L.—*W.*
West shore of Hinde Lake.
196. *Lycopodium Selago*, L.—*B.*
West shore of Doobaunt Lake
Ashe Inlet on Hudson Straits.

XLII. MUSCI.

197. *Sphagnum fuscum*, var. *pallidum*, Warnst.—*W.*
In swamp on the banks of Telzoa River, just below Daly Lake.
198. *Sphagnum tenellum*, var. *rubellum*, Warnst.—*W.*
Telzoa River, just below Daly Lake.
199. *Sphagnum acutifolium*, Russ. & Warnst.—*W.*
Telzoa River, just below Daly Lake.
200. *Dicranum elongatum*, Schwaegr.—*W.*
North end of Barlow Lake.
201. *Dicranum congestum*, Bird.—*B.*
West shore of Doobaunt Lake, at the mouth of Telzoa River.
202. *Dicranum fuscescens*, Turn.—*B.*
West shore of Doobaunt Lake, at the mouth of Telzoa River.

203. *Dicranum Bergeri*, Bland.—*W*.
West shore of Hinde Lake.
204. *Aulacomnium pulstre*, Schwaegr.—*B*.
West shore of Doobaunt Lake, at the mouth of Telzoa River.
Ashe Inlet on Hudson Straits.
205. *Polytrichum strictum*, Banks.—*B*.
West shore of Doobaunt Lake, at the mouth of Telzoa River.
206. *Wcbera nutans*, Hedw.—*B*.
West shore of Doobaunt Lake, at the mouth of Telzoa River. Ashe Inlet
on Hudson Straits.
207. *Hypnum exannulatum*, Guemb.—*B*.
West shore of Doobaunt Lake, at the mouth of Telzoa River.
208. *Hylocomium Schruberi*, Willd.—*W*.
Telzoa River, just below Daly Lake.
209. *Hylocomium splendens*, Schimp River.—*B*.
West shore of Doobaunt Lake, at the mouth of Telzoa River.

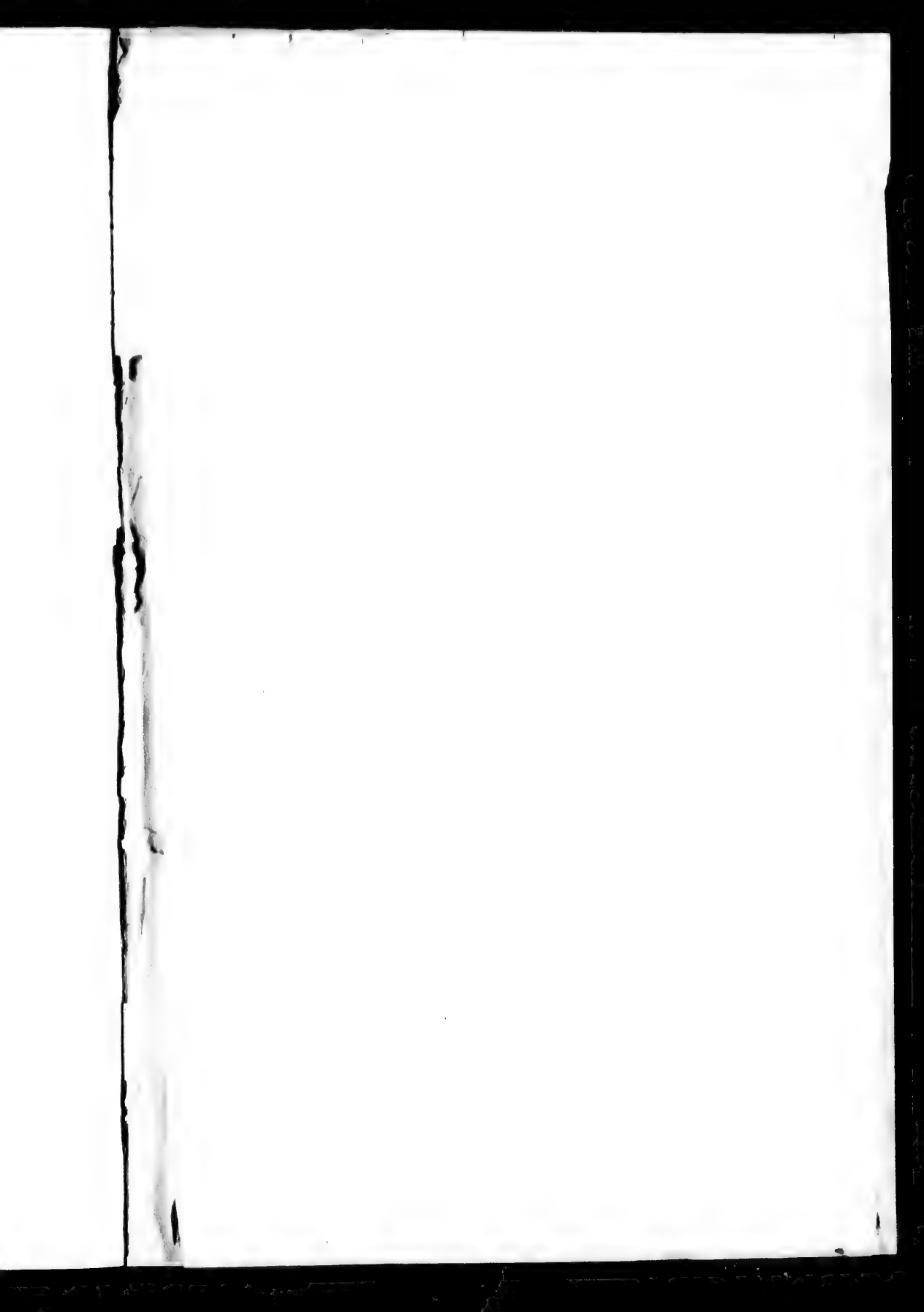
XLIII. HEPATICÆ.

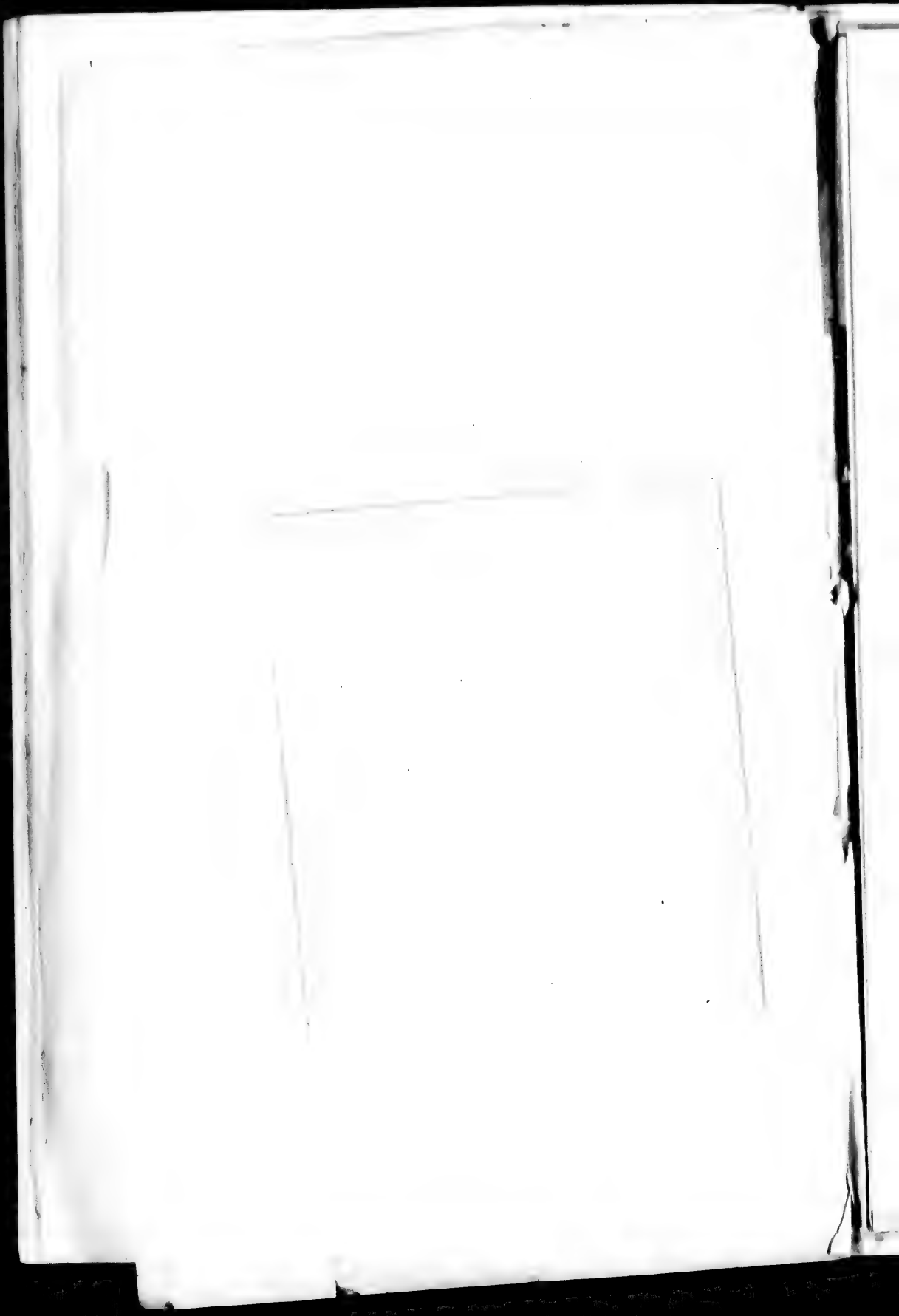
210. *Ptilidium ciliare*, Dum.—*B*.
West shore of Doobaunt Lake.

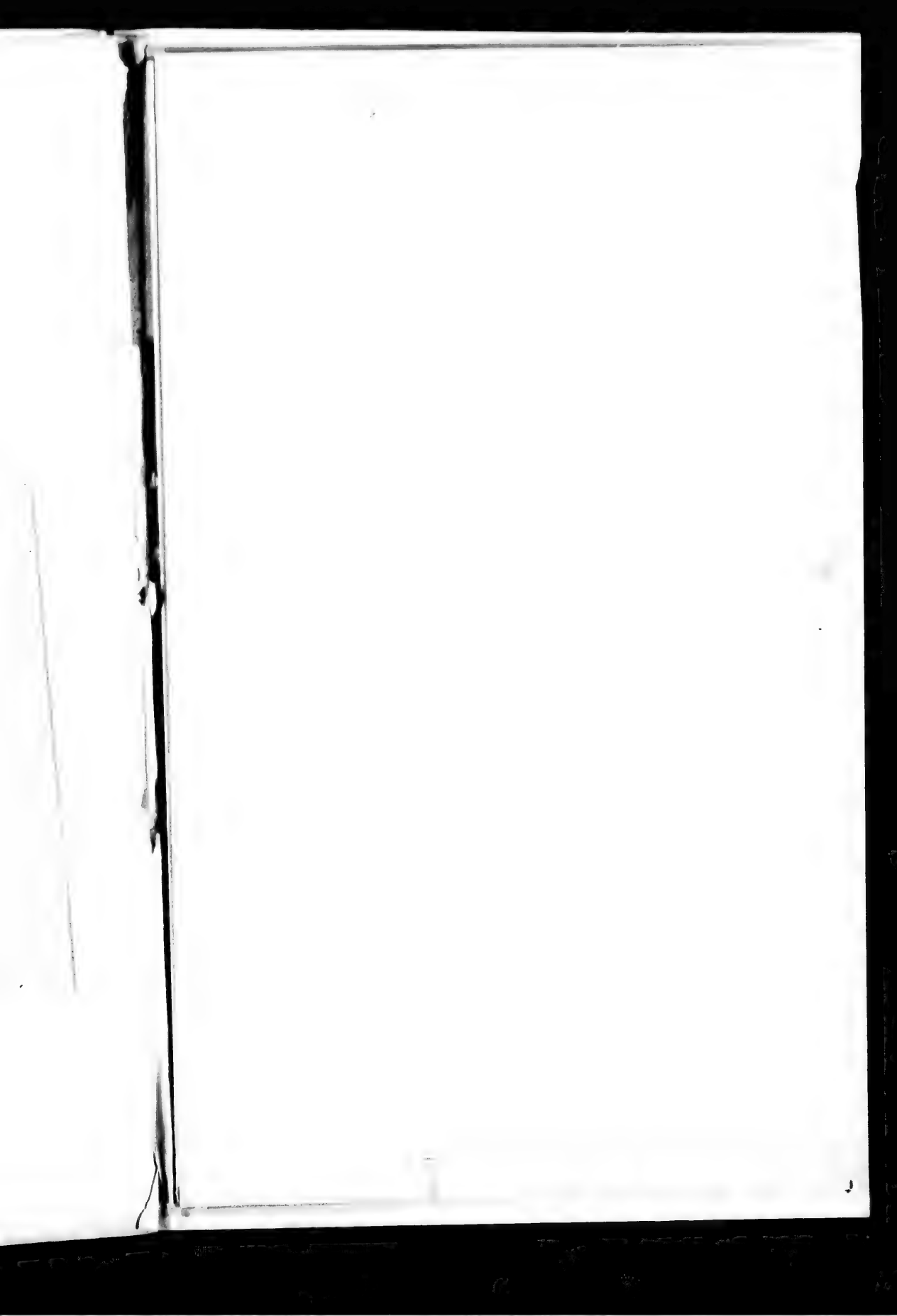
XLIV. LICHENES.

211. *Cetraria aculeata*, Fr.—*B*.
West shore of Doobaunt Lake.
212. *Cetraria arctica*, Hook.—*B*.
River bank between Nicholson and Doobaunt lakes.
213. *Cetraria Islandica*, Ach.—*W. B*.
Daly Lake. Hill at the north end of Barlow Lake.
214. *Cetraria Islandica*, Ach., var. *Detisei*, Bor.—*W*.
Telzoa River, just below Daly Lake.
215. *Cetraria Richardsonii*, Hook.—*B*.
West shore of Doobaunt Lake.
216. *Cetraria cucullata*, Ach.—*B*.
North-west angle of Doobaunt Lake.
217. *Cetraria juniperina*, Ach., var. *Pinastii*, Ach.—*W*.
Telzoa River, just below Daly Lake.
218. *Cetraria nivalis*, Ach.—*W. B*.
Telzoa River, just below Daly Lake.
North end of Barlow Lake.
Ashe Inlet on Hudson Straits.
219. *Alectoria jubata*, L., var. *implexa*, Fr.—*W*.
West shore of Hinde Lake.
220. *Alectoria divergens*, Nyl.—*W*.
Telzoa River, just below Daly Lake.
221. *Alectoria ochroleuca*, Nyl., var. (a) *rigida*, Fr.—*B*.
North end of Barlow Lake.
West shore of Doobaunt Lake.
222. *Parmelia physodes*, Ach.—*W*.
Telzoa River, just below Daly Lake.
223. *Parmelia conspersa*, Ach.—*W*.
Telzoa River, just below Daly Lake.
224. *Umbilicaria Muhlenbergii*, Tuckerm.—*W*.
Telzoa River, just below Daly Lake.

225. *Nephroma arcticum*, Fr.—W.
West shore of Hinde Lake.
226. *Lecanora tartarea*, Ach.—W.
Telzoa River, just below Daly Lake.
227. *Stereocaulon Despreauxii*, Nyl.—W.
Telzoa River, just below Daly Lake.
228. *Cladonia decorticata*, Floerk.—W.
North end of Barlow Lake.
229. *Cladonia gracilis*, Fr., var. *elongata*, Fr.—W. B.
Telzoa River, just below Daly Lake.
West shore of Doobaunt Lake.
230. *Cladonia rangiferina*, Hoffm.—W.
Telzoa River, just below Daly Lake.
North shore of Barlow Lake.
231. *Cladonia rangiferina*, Hoffm., var. *sylvatica*, L.—W.
Telzoa River, just below Daly Lake.
232. *Cladonia cornucopioides*, Fr.—W.
Telzoa River, just below Daly Lake.
233. *Bomyces aeruginosus*, D.C.—W.
Telzoa River, just below Daly Lake.

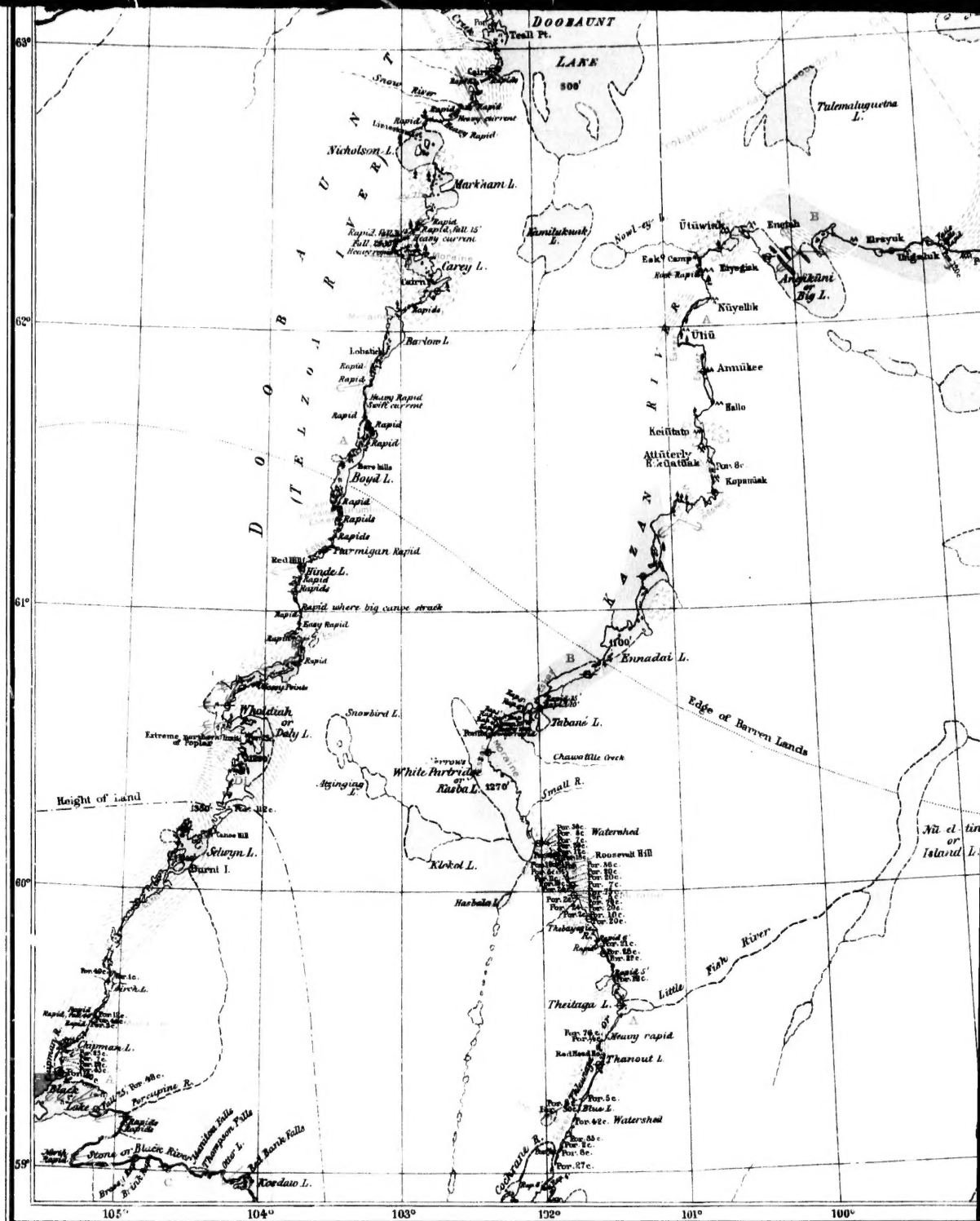








- C Cambrian (Alabasac sandstone and conglomerate)
- B Huronian
- A Laurentian (granitoid gneisses)
- A Massive granitic rocks
- Quartzite, porphyry and andesite (associated with Cambrian)
- Diorite, diabase, gabbro, etc.
- Glacial striae
- 690' Height above sea
- Por. 5c Portages (length in chains)
- Clump of trees
- Exposure camp
- Latitude station



J. White, Chief Draftsman
Compiled and drawn for photo-lithography
by C. O. Semcat, C.E.

DOOBAUNT and KAZAN R.

To acc

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Accompanying Part F, Vol. IX (New Series), 1896

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MAP
of

DOOBAUNT and KAZAN RIVERS and NORTHWEST COAST of HUDSON BAY

To accompany Report by J. Burr Tyrrell, M.A.

Natural Scale: 1:864,000

Scale 25 m. to 1 inch

